THE AEROPLANE and ASTRONAUTICS

JULY 13, 1961

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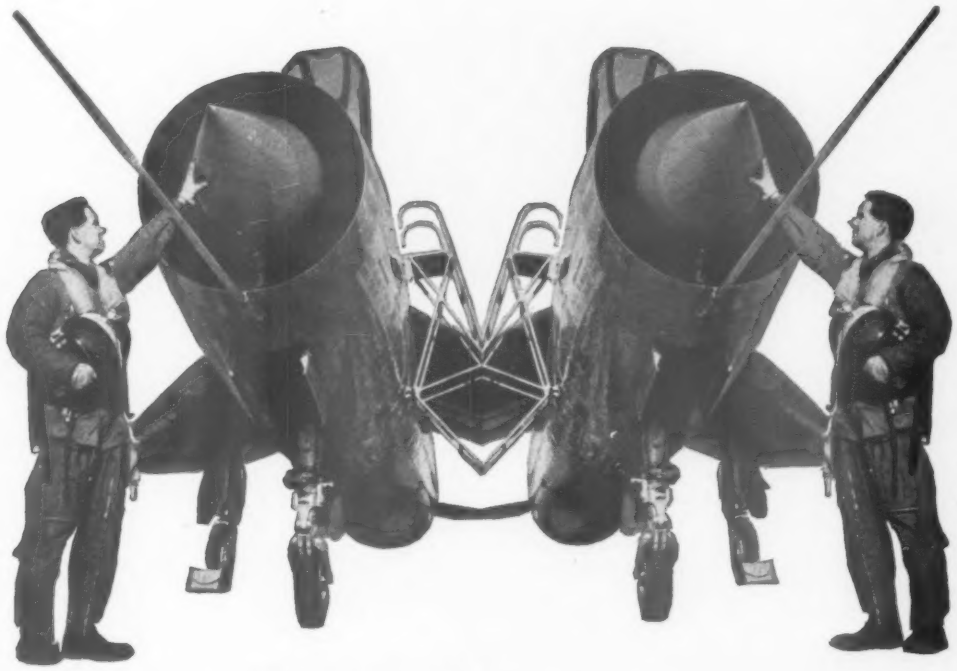

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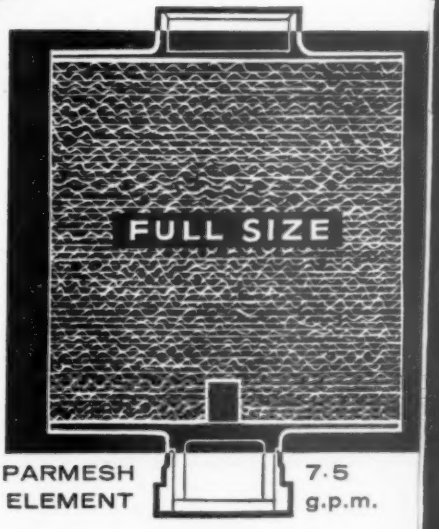

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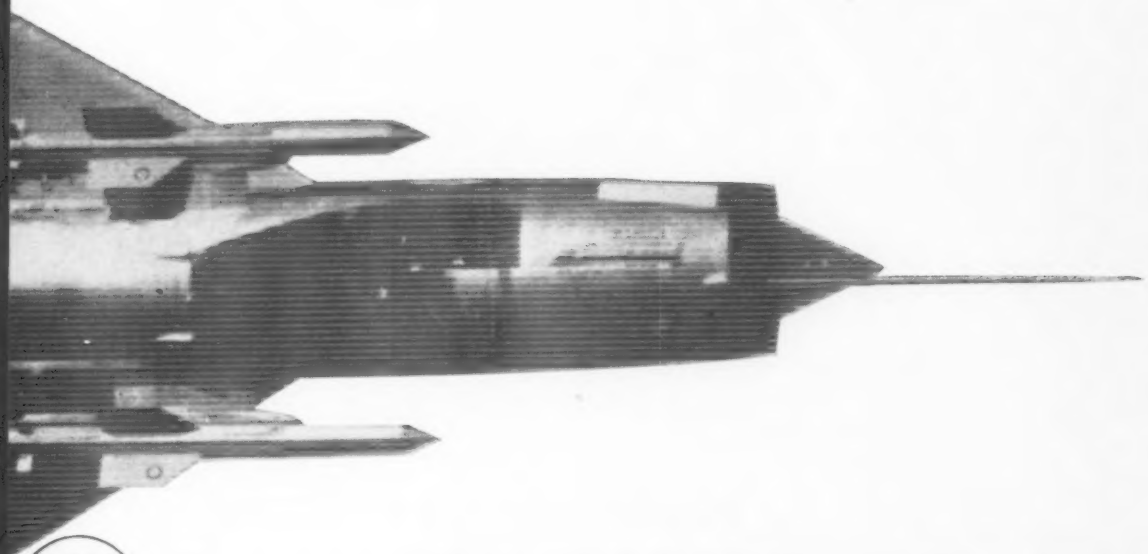

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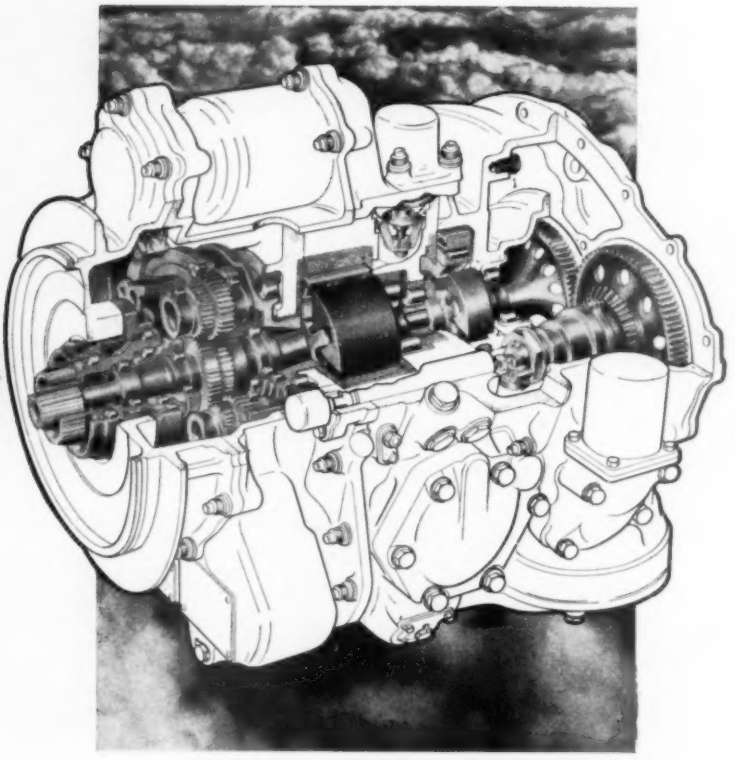

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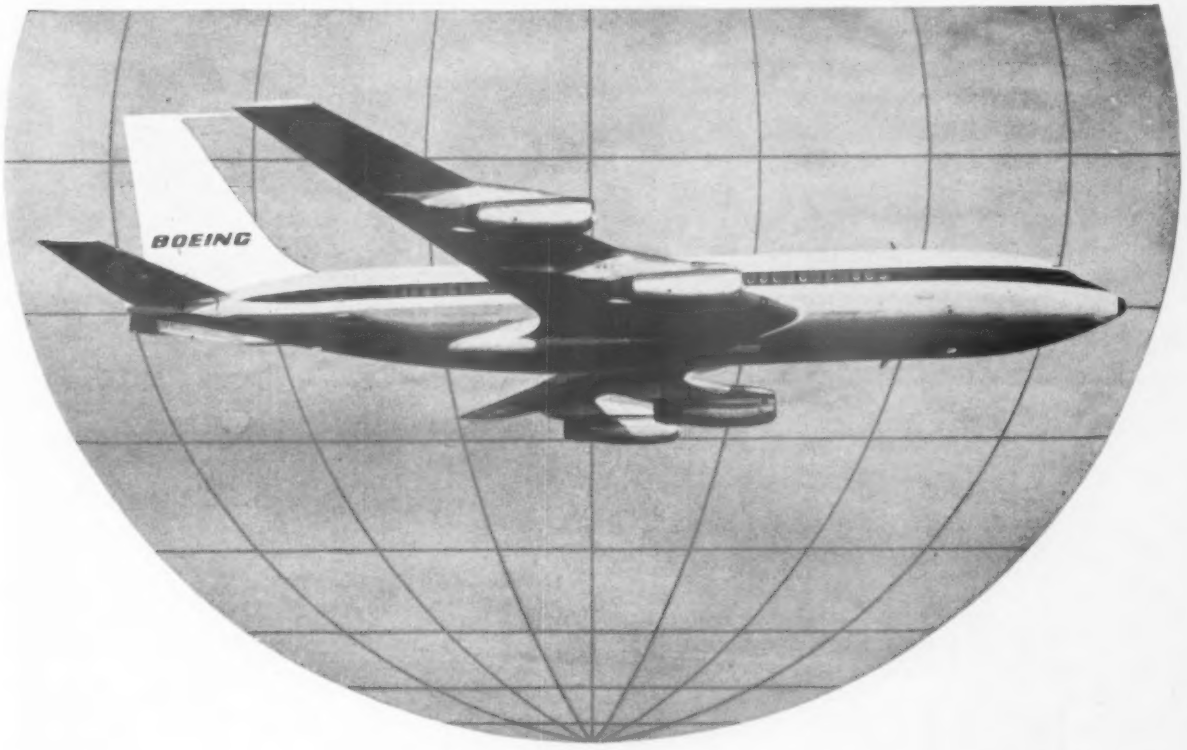

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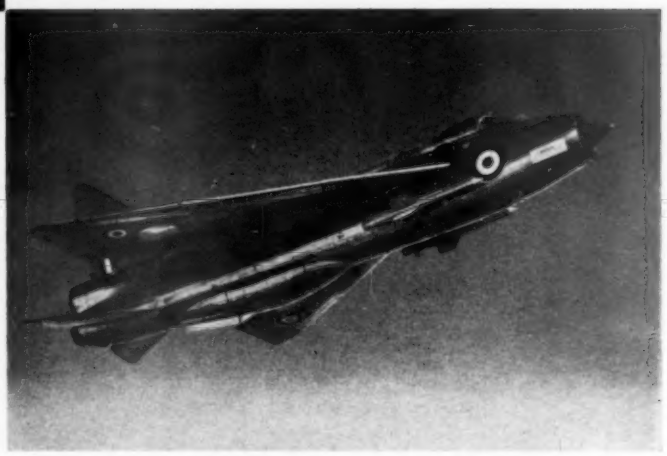

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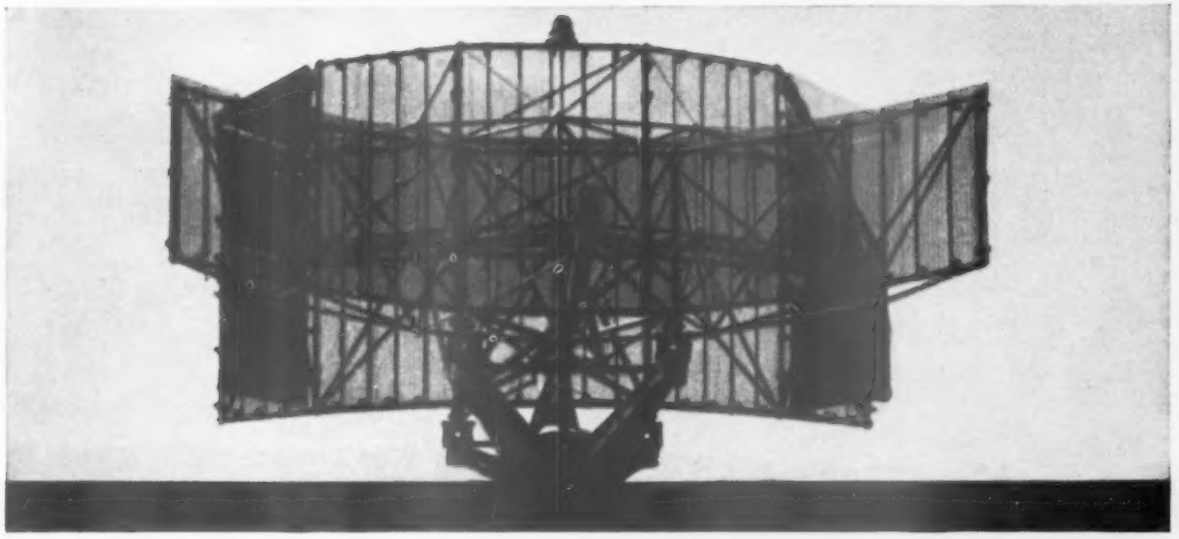

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THE AEROPLANE and ASTRONAUTICS

VOLUME 101 NUMBER 2595 JULY 13, 1961

Implications of Strategy

Impact of the Tushino Air Display was, as Mr. Khrushchev and his advisers intended it to be, stunning in its display of air potential. And that impression will not be lightly eradicated. Issuing invitations to air attachés and the Press and permitting such an audience to bring cameras which they were at the last moment forbidden to use, no doubt accounts for the present lack of photographs of the newest types said to have been shown in public for the first time. Broadly speaking, as our commentary on p. 32 makes clear, most of the new types of which photographs are available are already reasonably well known to Western expert observers and commentators.

Mr. Khrushchev's public observations are made for tactical reasons and as with all tactical activities apparent contradictions are not unusual. To hold a display of such magnitude as that of Tushino may have been in accord with tactical considerations. But those versed in the practice of aeronautics will not have any doubts of the implications. The presence of such advanced designs in production quantities can in no way be attributable to tactical decisions changing at short intervals. Russia's aeronautical might as displayed last week can only have come into being as the result of strategic decisions made years ago; how many years we wonder before the famous White Paper of 1957 in which our Government declared the end of the manned fighter aircraft and the replacement of the aeroplane by the guided missile?

Air supremacy can only come from consistency in planning and that is something this country has lacked for far too long.

Helicopters for Airlines

There seems to be no doubt that plans are being worked out between B.E.A. and Sabena for the joint operation of a helicopter service (see p. 35). We imagine that the six aircraft involved, almost certain to be Boeing-Vertol 107 helicopters, will not be bought entirely by B.E.A. The fleet is much more likely to be the result of B.E.A. buying two or three and Sabena doing likewise. What would be sensible would be for Sabena, as the airline with years of helicopter operating experience, to do the maintenance. However, if, as seems the proper thing to do, the aircraft are equipped with British-built powerplants, B.E.A. should service these.

To those who have been arguing for years that helicopter operations should be inaugurated as part of our airline network even this amount of positive news seems lamentably tardy. It is seven years ago since Mr. Vernieuwe of Sabena came in person by Sikorsky S.55 to the South Bank to show what Sabena could do and was prepared to do. B.E.A. and the British civil aviation authorities decided to wait until a practical British helicopter was available. Seven years later no British helicopter is available to meet B.E.A.'s requirements. The Rotodyne has been tragically delayed and the service, if and when it is started, will be started with machines built overseas.

So we seem to have been holding out against a Sabena-operated helicopter service for seven years to no good end. For how many years have we been wanting a director of helicopter development and operations responsible to the Minister responsible for civil aviation? We have to put it in that complicated manner as the Government is always changing its mind as to who should look after civil aviation. And as we have said in another context, changing tactics are no substitute for consistent strategy.

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Matters of Moment

The Go-ahead for Eurospace

NOW that West Germany has agreed, after much deliberation, to support the Anglo-French proposal to develop Blue Streak as a heavy satellite launcher, the European Space Launcher Programme which many people in this country have striven so hard to realize now seems to be assured. What this will mean for the future of aerospace industry on this side of the Atlantic it is difficult to forecast at this stage, but clearly the possibilities are present for a steady expansion of effort both in the scientific and commercial fields. The effect on Australia, too, should be far reaching since Woomera will now be joining such World-famous names as Cape Canaveral, Vandenberg and the Soviet Baykonur as a site for space-launching operations.

For Europe itself, an imaginative venture of this kind should provide a strong welding force for future collaboration. This should be effective not only in the aerospace fields, but in many others which may greatly influence the economic growth of each participant.

The fact that Germany had agreed to join the proposed organization, which was the subject of 12-nation discussions in Strasbourg last February, was announced by the Ministry of Aviation on Jly. 5, when it was stated that the governments of France and the United Kingdom hope to be able to call another conference for the purpose of drafting a convention "at an early date." On page 52 are first details of the French second-stage unit for the Blue Streak booster.

The M.o.A. has given this broad outline of how the proposed organization might work:—

The organization would be controlled by a governing body on which each of the participating governments would be represented. Within the framework of the convention the governing body would determine the policy of the organization and supervise the agreed programme. It would also decide in which countries the third stage of the launcher and satellite test vehicles for proving the launcher would be developed. The seat of the governing body would be for any forthcoming conference to decide.

The staff of the organization would be an international body with representatives from each of the member states; and the development and construction of launchers and test satellites would be carried out by means of contracts placed either by the organization itself or by the governments of member states. The allocation of contracts and sub-contracts would be determined by the organization on the basis of a rational distribution of work among members.

Arrangements would be made for technical information acquired in the course of any project to be freely exchanged by member states. All participants would be given an opportunity of joining in the scientific, engineering and other work of the organization. This would enable them to enjoy the many scientific and commercial benefits that could arise from the development of satellite launchers for peaceful purposes. Dissemination of technical information and knowledge would be helped by the employment of nationals of each member state in the work being undertaken on behalf of the organization in government establishments and industrial firms of other countries.

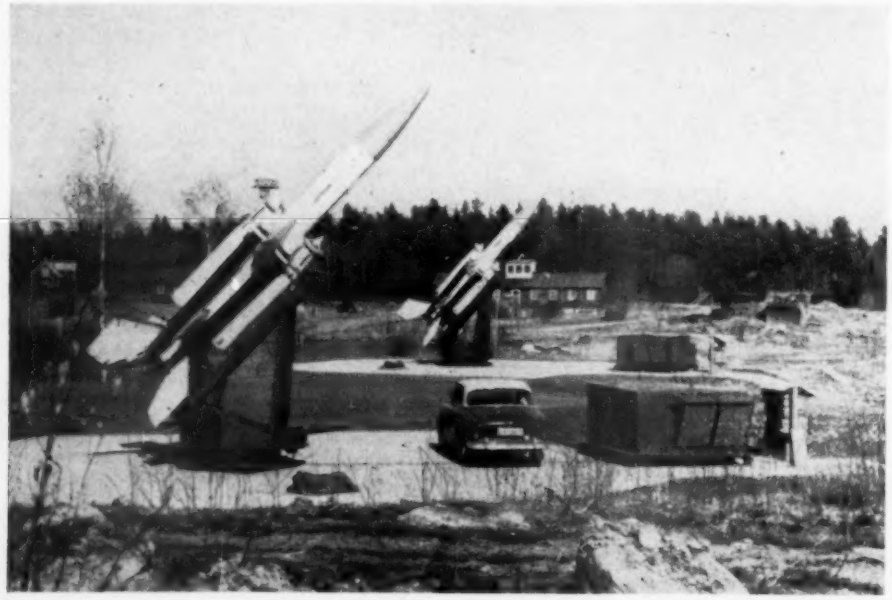
MISSILE PRESENTATION.—Gp. Capt. N. H. Dahl, the Swedish Air Attaché (right), is presented with a model of the Bloodhound by Lord Caldecote, executive director, guided weapons, of the British Aircraft Corporation, to mark the announcement of Sweden's new order for these weapons.

The closest co-operation would be maintained with the projected European Space Research Organisation proposed at the conference at Meyrin in December, 1960, for collaboration between European countries in carrying out scientific research into space.

New Bloodhounds for Sweden

LAST week's announcement that the Royal Swedish Air Force Board had ordered a quantity of Mk. 2 Bristol/Ferranti Bloodhound surface-to-air guided missiles was welcomed as the first news of an overseas order for this advanced anti-aircraft weapon system. It was also disclosed that this was the largest contract to be placed by a foreign government for a British guided missile system.

It was, however, not altogether surprising that Sweden should choose this particular weapon because Bloodhound Mk. Is have been an integral part in that country's air defence system for some years—the first Swedish order for the missiles was placed in September, 1958. The adoption of its successor is a logical step towards bringing the system "up to date." The Royal Swedish Air Force Board has, in fact, said that Bloodhound 2 will complete the country's fighter defence and make it more efficient "since this guided weapon system can be used against targets at the highest and lowest altitudes and gives a very high degree of readiness at a reasonable cost."



SWEDISH DEFENDERS.—Bristol/Ferranti Bloodhound surface-to-air missiles on their launchers at a Royal Swedish Air Force station; as recorded on this page these missiles are to be supplemented by Mk. 2 versions which have now been ordered by Sweden.

SUPERSONIC INTERCEPTORS.—Now in squadron service with the Royal Air Force, and in quantity production at four factories in Lancashire, the English Electric Lightning is the subject of a feature article and detailed cutaway drawing elsewhere in this issue.

Photograph copyright "The Aeroplane and Astronautics"

Few details of this new Bloodhound have been made available. According to the British Aircraft Corporation, while it closely resembles the earlier version externally, the Bloodhound Mk. 2 weapon system "offers striking advantages in virtually every aspect of performance. It is also fully air-transportable. The new weapon system possesses greater range, greater lethality and greater operational flexibility."

The most important single factor in these improvements, the company adds, is the use of continuous-wave radar guidance, developed in conjunction with the Ministry of Aviation by Associated Electrical Industries and Ferranti. Apart from enabling Bloodhound's radar range to be extended, the adoption of CW radar guidance "has made it possible to achieve great lethality against all types of target down to very low altitudes, even in the face of highly sophisticated electronic countermeasures."

Non-hovering Rotators

AUTOGYROS are working their way into the news. We use the word to describe rotating-wing machines in which the translational thrust is obtained from an airscrew or turboprop. Such machines are not capable of sustained vertical climb without forward motion nor of hovering flight. They have the merit, as was demonstrated extensively before the 1939-45 war, with their comparative mechanical simplicity, of reliability and low first cost.

We recently published a report from Luton of the Napier-built low power autogyro now flying there. We understand it is to be demonstrated publicly in the near future. A letter about the Skyskooter, as it is called, will be found on page 55.

From Shoreham it is reported that considerable progress has been made with the Wallis gyrocopter, already described and illustrated in THE AEROPLANE AND ASTRONAUTICS on Aug. 28, 1959. This McCulloch-powered machine has been undergoing considerable development and it is understood that Beagle aircraft are interested in its future.

Noise and Supersonics

DESCRIBED by the Parliamentary Secretary to the Ministry of Aviation as one of the great events of the aviation calendar, the Air Registration Board's annual luncheon held on Jly. 6 was no exception. And once again the Board's chairman, Lord Brabazon, had some forthright things to say—this year, about noise and supersonic airliners.

It was laid down a long time ago, he said, that civil aviation should be civil; but a certain amount of incivility has crept in due to the introduction of the straight jet. "Now we have come to hear about the introduction of a new horror—the supersonic airliner. The trouble about it is that we do not know what noise it is going to make.

"It appears that we know little about it, except that noise is a function of speed and the size of the aircraft. Consequently we are ignorant; but the experts from the United States tell us that at 20,000 ft. it will break your windows, and at 50,000 ft. aircraft of this type will give you a noise like a clap of thunder when lightning is striking 100 yd. away . . ." Lord Brabazon went on to say that first things must be done first and that we must know what the noise is going to be "before we start on this enterprise."

After commenting that the taxpayer has been extraordinarily tolerant relative to the aircraft industry over the "ghastly mistakes" it had made and the way money had been squandered—he referred specifically to the Bristol Brabazon, the Princess flying-boats and the cancellation of the Vickers V1000—he roundly declared his fear that "even more colossal blunders" would be committed in building "this type of supersonic machine." It would cost £100 million, whether made nationally or internationally.

MR. GEOFFREY RIPPON, Parliamentary Secretary to the M.o.A., responding to Lord Brabazon's toast to the Ministry, spoke of the problem of safety—which, he said, was apt to cost money, affect payloads, or cause inconvenience; and involved rules, regulations and a certain amount of form filling. The Ministry of Aviation attached the very highest importance to air safety and he took the opportunity of thanking the A.R.B. for its advice on the standards of operators' maintenance requirements introduced for the new Air Operators' Certificate.

Later he said that the aviation industry had much of which to be proud. It was making "a great and growing contribution to the strength of our economy." Exports of aircraft, engines, ancillary parts and electronic capital goods had more than doubled since 1955 and accounted for nearly 5% of our total exports.

MAJOR R. H. THORNTON, in his inimitable way, charmingly and entertainingly proposed the toast to the guests.

The director of R.A.E., MR. M. J. LIGHTHILL replied. He disclosed that the R.A.E. was just about to launch a full investigation into what could be achieved in opening up a completely new market for short-distance air travel.

Racing at Coventry

THIS year's final of the National Air Races and the Lockheed aerobatic championship begins today, Jly. 13, at Baginton, Coventry, and culminates on Saturday with the main event for the King's Cup. Today is occupied with the preliminaries for the Lockheed Trophy, eliminating all but six of the 17 entrants for the final on Friday, from 14.00 hrs.

Twenty-two entrants are competing for the King's Cup, which begins half-way through Saturday afternoon's flying display programme, and this contest will also decide the British Air Racing Championship for 1961. As well as the usual air display items from the R.A.F. and U.S.A.F., there will be the Mystère IVAs of the Patrouille de France, the Skydivers of the S.A.S. Regiment and a fly-past of modern executive aircraft.

Participants for the King's Cup are:—

Sqn. Ldr. C. P. Francis, Turbulent, G-ARIZ; C. Gregory, Taylorcraft, G-AHGZ; I. Trethaway, Tiger Moth, G-AOAA; G. Rees, Tiger Moth, G-AOUY; N. H. Jones, Tiger Moth, G-ARAZ; P. G. Masefield, Chipmunk, G-AOTM; J. M. Donald, Tiger Moth, G-ANZU; J. W. C. Judge, Tiger Moth, G-ACDC; C. E. Elton, Tiger Moth, G-ANZZ; Peter Vanneck (entrant, N. H. Jones), Tiger Moth, G-APRA; Sqn. Ldr. H. B. Iles, Miles M.18, G-AHKY; Flt. Lt. R. Crowhurst (entrant, A. J. Linnell), Comper Swift, G-ABUS; S. M. Aarons, Miles Hawk Tr., G-AIUA; D. Hartas, Arrow Active, G-ABVE; Sheila Scott, Jackaroo, G-APAM; Capt. G. P. Watson, Proctor 3, G-AOEJ; T. G. Knox, Proctor 3, G-AHID; P. Blamire, Gemini, G-ALZC; Wg. Cdr. McIntosh (entrant, M. D. N. Wyatt), Cessna 175, G-APZS; G. C. Marler, Falcon 6, G-ADTD; R. R. Paine, Speed Six, G-ADGP; V. H. Bellamy (entrant, The Earl Mountbatten), Spitfire Mk. 8, G-AIDN.

Competitors for the Lockheed Trophy comprise:—

Flt. Lt. J. R. Ayers, Tiger Moth, G-AOAA; C. Boddington, Tiger Moth, G-AOAA; M. Popoff, Tiger Moth, G-ANZZ; N. G. Pocock, Tiger Moth, G-ANZZ; J. d'Hulst, Stampe S.V.4C, F-BEKI; J. d'Orgeix, S.V.4C, F-BBUF; M. Charollais, S.V.4C, F-BDGI; G. J. M. Verette, Morane M.S.350, F-BDYL; L. Delhomme, S.V.4A, F-BDMO; J. Falloox, S.V.4A, F-BDMO; F. Liardon, Jungmeister, HB-MIC; A. Ruersch, Jungmeister, HB-MIE; F. D. Price, Jungmeister, EC-ALP; J. Blaha, Zlin Z.226, J. Hulka, Zlin, L. Trebaticky, Zlin, J. Stoklasa, Zlin.

OPtional Reading—2

LAST WEEK I mentioned the "Vertical Separation" Panel and the "Panel for Co-ordinating Procedures Respecting the Supply of Information for Air Operations" and traced their somewhat chequered careers. This week I will deal with the (apparently inarticulate) R/T Speech Panel and the Visual Aids Panel.

The R/T Speech Panel began life about 1954 and was set up primarily to deal with the problem of providing a Worldwide common language between pilot and controller. This had, of course, already been accomplished in certain very specialized fields such as GCA; however, there was no common language (unless one counts the Q Code, and that could scarcely all be memorized for voice communications) for the bulk of A.T.C. and MET operational messages and, although there had, by the early 1950s, been a small advance in the knowledge and use of English, as compared with the immediate post-War years, there were still many stations where English was poor and a few where it was non-existent. Nor did the problem appear to be capable of improvement beyond a certain point, since there was a tendency, once a controller acquired a reasonable mastery of English, for him to find another (more remunerative?) job and be replaced by a novice. Further, the wider use of voice for long-distance communications meant that the problem of language was no longer confined to the Approach and Tower but applied equally to all stations en route.

Incidentally, many people think that all international A.T.C. centres are *obliged* to use the English language. This is not so; Annex 10, paragraphs 5.3.1.1 and 5.3.1.2 have the status of "Recommended Practices," not "Standards." Hence States can, and do, depart from them. The actual wording is:—

> 5.3.1.1. Recommendation.—In general, the air-ground radiotelephony communications should be conducted in the language normally used by the station on the ground.
>
> Note: The language normally used by the station on the ground may not necessarily be the language of the State in which it is located.
>
> 5.3.1.2. Recommendation.—Pending the development and adoption of a more suitable universal aeronautical radiotelephone language, the English language should be used as such, and should be available, on request from any aircraft station unable to comply with 5.3.1.1., at all stations on the ground serving designated airports and routes used by international air services.

But clearly, where the authority does not require English from his controllers, the use of the local language often makes it difficult for the pilot; and, where the authority does insist on English, the use of the full range of the language would often be difficult of attainment by the controller. So, as visualized in para. 5.3.1.2, a long-term solution was sought and the machinery set up in the form of an ICAO "International Language for Aviation Panel." However, early studies indicated that a new complete language was quite impracticable; the Panel therefore got its terms of reference reduced accordingly and its name changed to "The R/T Speech Panel." It met in 1955 and decided to concentrate first on the phraseologies used in emergency; it then began a detailed study of sentence structure and phonetics. What a wonderful field for the expert! And the various Governments saw to it that the Group had its experts: out of the 10 members on the Panel only one was a pilot; and the controller was not represented at all. This on a pilot/controller problem! The result, after six years: nothing.

But not all ICAO panels are abortive. The former Airworthiness Panel did a good job in preparing the ground for a common certification code for jet aircraft. And the Visual Aids Panel, in its early personification, went a long way towards standardizing runway and taxiway marking; later, the reconstituted Panel set the course for a standard visual approach-slope indicator (the R.A.E. VASI) at all international airports and laid down, subject to further evaluation, the requirements for narrow-gauge runway lighting (button or flash units, two rows, 60-75 ft. apart, 3,000 ft. long; lights in the rows 200 ft. apart; centre-line button lights also required end to end of runway).

Now the point about these recommendations of the Visual Aids Panel is not that they necessarily represent in each case the *optimum* specification (indeed, a recent Australian report indicates the possible superiority of an entirely new configuration of VASI, the Precision Visual Glide Slope Indicator (PVG)), but they do represent a *practical* specification. In the case of visual glide slope indicators, the Panel recognized that any evaluation of an entirely new system would mean a delay of about a year in achieving an international standard, and of longer in securing Worldwide installation. So, as the R.A.E. VASI had been proved to fill the operational requirement and was actually in production in the U.K. and U.S., it was recommended for universal installation. However, the evaluation of new systems (including the PVG) was also specifically encouraged. For once the OPS personnel on the Panel were in the majority (it was chaired by Capt. B. E. Bressey, the representative of IFALPA); for once, the terms of reference were answered, and that at a single session. The only criticism one might offer here is that had the Council of ICAO set the Panel up two years ago (when the VASI had already proved itself), accidents such as that to K.L.M.'s Electra (Cairo, Jne. 12) would almost certainly not have occurred.

The above problem of the constitution of Panels, Committees and Divisional meetings has, fortunately, now been recognized by the Council of ICAO. Henceforward it will be rare for these bodies to meet alone as undiluted groups of experts: they will, so far as practicable, always have strong OPS element in them. This decision is already reflected in the directives to the VII COM Meeting (January, 1962) and in the suggestion of establishing an OPS Panel. (Incidentally, Mr. Calvert has recently spoken of the need for an OPS group though not necessarily connected with ICAO). But everything will depend on whether governments will actually send OPS personnel to these meetings.

The general purpose OPS man is a rare bird in government employment. Will the airlines lend him (i.e. their OPS manager, chief pilot or senior captain) to the governmental delegation? And who will pay him during the 2-4 weeks of the meeting? On the answers to these questions will depend the success of the Council's new venture and, with it, the success of many an important project.—C.C.J.

Helicopter Exports Efforts

LAST week's announcement of the order placed by the Australian Government with Westland Aircraft for 27 Wessex anti-submarine helicopters for the Royal Australian Navy, has been followed by some further information concerning the negotiation of this important contract.

This order, which is worth £6 million, was obtained in the face of intense U.S. activity to get American types adopted by the Royal Australian Navy, says Westland Aircraft. The American helicopters put forward, and against which the Gazelle-powered Wessex was finally chosen, were the Bell Iroquois and the Kaman Seasprite.

The task of getting the Australian Government to make a decision in favour of the Wessex, the company goes on, was made more difficult by the decision of the Royal Australian Air Force to order eight Bell Iroquois, and by the Government's desire to standardize on one helicopter for their Services.

However, the case for the Wessex was energetically argued in Canberra by a three-man team headed by Westland's deputy managing director, Mr. D. C. Collins. Discussions were held on the spot with the Ministers directly concerned and were resumed during the recent visit of Mr. Athol Townley, the Australian Defence Minister, to the U.K.

Westlands believe that the principal factor which influenced the final choice of the Wessex for Australia was the incompatibility of the differing R.A.A.F. and R.A.N. helicopter requirements. And the all-weather capability of the Wessex doubtless had a considerable bearing on its eventual selection.

As we recorded last week, the completion of this order is scheduled for mid-1963; the first Australian Wessex will come off the production line in the summer of next year. In service these helicopters will be part of the complement of the carrier H.M.A.S. "Melbourne."

The Westland Wessex is already in quantity production at Yeovil for the Royal Navy; the first R.N. squadron was, in fact, commissioned last week. For anti-submarine duties, the Wessex carries both detection gear and strike weapons. In a transport rôle, the helicopter can carry 18 fully equipped troops.

Russian Designers Recognized

RUSSIAN designers who have given good service have recently been listed in *Red Star*. The list contains the names of A. N. Tupolev, S. V. Ilyushin, A. M. Lyulka (engines), A. I. Mikoyan, V. M. Myasishchev (believed designer of Bison), P. O. Suchoi, S. K. Tumansky (engines), A. S. Yakovlev, D. K. Antonov, A. G. Ivchenko (engines), N. D. Kuznetsov (engines), M. L. Mil and "Miri."

In this list there is no reference to V. Klimov (modifier of the Nene to the V.K. series) or Lavochkin, who is believed to be working on rockets—his last recorded aircraft being the LA 15 which was of the same period as the MiG 15.

In a reference to recent flights, e.g., Mosolov's flight to 34,000 m. on the E-66, mention is also made of recent flights by Air Force pilots G. I. Kislov and I. A. Ukolov "of more than 12 hours" on unspecified aircraft.—F.J.F.

Soviet Air Power Displayed

Some of the new military aircraft which appeared at Tushino last Sunday, Jly. 9. Overleaf is an account of the two-hour programme and comment on the aircraft.

A space-vehicle, right, said to represent the Vostok spacecraft in which Major Gagarin orbited the Earth on Apr. 12 was shown beneath an Mi-6 transport helicopter. The vehicle is over 35 ft. long.

Above, yet another version of Yakovlev's tactical Yak-25 "Flashlight," this modified "C" has bigger turbojets. Below, the massive supersonic "Bounder" bomber was accompanied by Sukhoi delta fighters.

Above, with a new four-legged stalky undercarriage, this Mi-6 variant showed its aerial crane capability. Right, first picture of the missile-carrying "Backfin."

Two photographs above show the day and all-weather variants of the Sukhoi "Fishbed" interceptor. The former has no radar, but carries cannon and Sidewinder-type missiles, while the radome-equipped type above dispenses with guns in favour of Sparrow-type radar-guided underwing weapons.

Shock Tactics at Tushino

AFTER five years of silence and security on the display and development of Russian military aircraft, there were some startling revelations at the mammoth air day at Tushino last Sunday. This display of military air power coincided with an announcement by Mr. Khrushchev that the Soviet Union's defence budget is to be increased by one-third (£1,257 million) and that all reductions in the Russian armed forces are to be suspended. This was clearly all part of the Russian political offensive for the neutralization of Berlin.

About 10 new aircraft types are reported to have been shown at the Tushino display by Western observers, who were said to have been prevented from photographing them. This presumably accounts for the absence of pictures of such stimulating items as a new jet bomber with twin rear fuselage-mounted powerplants à la Caravelle, a Rotodyne-type twin-turboprop Kamov convertiplane, with wing-tip rotors, called the Vintokrilya (screw wing) described as for military and cargo use, and the first public appearance of the Beriev Be-8 jet flying-boat.

Illustrations have, however, been released by the Russians of several other new and interesting types, which show that one of the main features of the Tushino display was the demonstration of a remarkable range of air-launched missiles. These ranged from both radar-guided and heat-seeking air-to-air types carried by differing versions of the Sukhoi delta-wing fighters, to air-to-surface weapons for tactical and strategic launching from the massive Bear (apparently a Blue Steel type) and the supersonic Backfin and Bounder bombers.

Both the last-mentioned aircraft appeared "in the flesh" over Moscow for the first time, confirming previous Western reports of their existence. Backfin, which has been credited to Yakovlev, conformed fairly closely to sketches and models built up from earlier unofficial sightings, as a mid-wing twin-jet bomber, with high-mounted cheek intakes having centre wedges. The four-jet Bounder, except for having a tail assembly for its long fuselage, is similar in layout and function to the Mach 2 delta-wing B-58 Hustler. It seems, however, about twice the size of its U.S.A.F. counterpart.

One of the points about the Tushino display is that most of the aircraft types were shown in quantity, rather than as prototypes, which indicates that they had probably reached Service status.

It seems clear that the Soviet Air Force has a new standard interceptor in the Sukhoi delta, which was shown in both day-fighter and all-weather versions. Code-named "Fishbed," the day-fighter variant has no interception radar, and with conventional cannon armament plus underwing air-to-air missiles which conform remarkably closely in appearance to the infra-red Sidewinder, is clearly intended for the classic visual/stern-chase interception rôle. "Fishbed B," on the other hand, has a massive central radome in its nose intake, no cannon beneath the fuselage, and underwing air-to-air missiles resembling the radar-guided Sperry Sparrow, for all-weather/collision course interception.

Two variations of the Yakovlev transonic fighter-bomber "Flashlight C" were shown; in addition to the previously seen aircraft with slim underslung nacelles, a more advanced model with much more bulky powerplants having centre-body shock-cones also appeared.

A development of the big Mi-6 helicopter with a stalky four-legged undercarriage showed its adaptation as a flying-crane by lifting a prefabricated house, while a standard Mi-6 carried Gagarin's bulky-looking Vostok spacecraft. Other new helicopters are also reported to have been shown.

A MiG jet fighter took off from Tushino, possibly zero-launched, with the aid of rockets, while another showed the use of liquid-rocket boost for interception by cutting in its extra motor with a bang and climbing nearly vertically out of sight. There were the usual parachuting items, and some civil aircraft participation, including fly-pasts of the Tu-124 and An-24.

This year's Tushino display was organized by Gen. Lt. A. Kutasin, Sov.A.F., assisted by Gen. Maj. V. Lavsky, chief navigation officer, and Gen. Lt. E. Gorbatyuk. It was opened at 10.00 hrs. local by Maj. Shvetsov, giving an individual aerobatic display in a MiG-19, and he was followed by the formation of three Sukhoi deltas, identified as E-66s (for height-record purposes).

Aviation News in General

BUCCANEER OUT EAST.—Blackburn Buccaneer S.1 XK 526 is at present on its way by sea to Singapore for tropical trials. It will be flown by naval pilots of C Sqn., A. and A.E.E., Boscombe Down.

OXON SURVEY.—Approximately 422,000 acres of Oxfordshire are to be photographed by Fairey Air Surveys, Ltd., under a contract awarded by the County Council. This will be done from 4,000 ft. giving a contact scale of 1/8,000 or eight miles to an inch.

NIPPON AMPHIBIANS.—Japan, the 13th country to use the Grumman Albatross, has taken delivery of four of the six it has on order.

OMNIPLANE RESEARCH.—Further ground and wind-tunnel testing of the Vanguard Omniplane Model 2 is to take place under a U.S.A.F. contract. This aircraft has ducted fans buried in the wings for VTOL. A Lycoming T53 provides power for forward flight.

TRANSATLANTIC TIE-UP. — A broad agreement covering the exchange of technical information and availability of manufacturing facilities and sales promotion of products has been made between Grumman Aircraft Engineering Corpn. and Louis Breguet.

DISCOVERER CATCH.—The capsule ejected from Discoverer XXVI was successfully air-snatched by a patrolling C-119 over the recovery area near Hawaii on Jly. 10. Launched on Jly. 7, the capsule was commanded to re-enter on the 32nd orbit. It was the fourth successful aerial recovery.

NIGERIAN GULFSTREAM. — A Grumman Gulfstream executive transport has been purchased by the Government of Nigeria for the use of the Prime Minister and other members of the Government.

ISRAELI BALLISTICS.—A three-stage, all-solid, meteorological sounding rocket, Comet II, wholly engineered in Israel, was launched from a site in the Negev Desert on the Mediterranean coast on Jly. 5. It rose to a height of nearly 50 miles to release a cloud of sodium vapour. Total weight was about 5 cwt. A second rocket is being prepared for carrying instruments and radio telemetering equipment.

SUPER SOLID.—A solid propellent, segmented, rocket engine producing 500,000 lb. s.t. was successfully test fired by Aerojet-General on Jne. 3. Made up of three segments, manufactured separately and assembled at the test site, the motor contained more than 100,000 lb. of propellent, was 30 ft. in length and had a maximum diameter of 8ft. 4 in.

SPACE ANTENNAE.—Two 75-ft. aerials, similar to those which will be used in the Canadian Topside Sounder satellite, to be launched next year, were successfully tested 561 miles above the Earth on Jne. 15. The spring-steel tubular aerials were extended from the nose-cone of a Javelin rocket launched from Wallops Island, Virginia. Details of the satellite installation were given exclusively in THE AEROPLANE AND ASTRONAUTICS on Feb. 24, 1961, pp.202-204.

(*More news items are on page 51*)

"FLYING BARREL".—This Saab J 29F is one of 15 being supplied to the Austrian Air Force. The first was delivered on Jne. 28.

Air Transport

S.A.S. Reorganization

MR. CURT NICOLIN, a Swedish industrialist, has been appointed president of S.A.S. for a short period in succession to Mr. Ake Rusck, whose resignation last week followed the recent financial difficulties which have beset the Scandinavian airline (see our issues for Feb. 24 and May 11). Mr. Nicolin, who is president of ASEA, a large electrical concern, is expected to undertake a top-level reorganization in S.A.S. during his term as "caretaker."

Mr. Rusck had been president of S.A.S. since Jan. 1, 1958, and has also been president of IATA since last September. It is not yet known whether he will continue in the latter post for the remainder of his term of office.

The parliaments of Sweden, Norway and Denmark have recently voted in favour of granting S.A.S. additional capital of £14.5 million, as recommended by the governmental committee which investigated the airline's affairs.

The European Routes Case

THREE whole days last week were given over by the Air Transport Licensing Board to the continued public hearing of applications by independent airlines to operate 72 routes in Europe and domestically in the U.K. These were days 5, 6 and 7 in the series; events of the first four days have been reported in our issues for Jne. 29 and Jly. 6.

When the hearing resumed on Jly. 4, Sir George Cribbett concluded his evidence with the opinion that there was little likelihood of the Government re-negotiating bilateral agreements to be more favourable to the U.K. He had previously explained the historical background of most of the European bilaterals, which in general limit the U.K. share of the total traffic between Britain and any other point in Europe to about half.

The next witness for B.E.A. was the corporation's economic adviser, Mr. Stephen Wheatcroft. In his opinion European and domestic routes were not yet ready for competition. There was very rapid technological progress which was more than keeping up with the number of people travelling by air. Competition on the domestic routes might lead to the introduction of jet aircraft; if this service was more expensive to operate than at present, the public gain would be open to doubt.

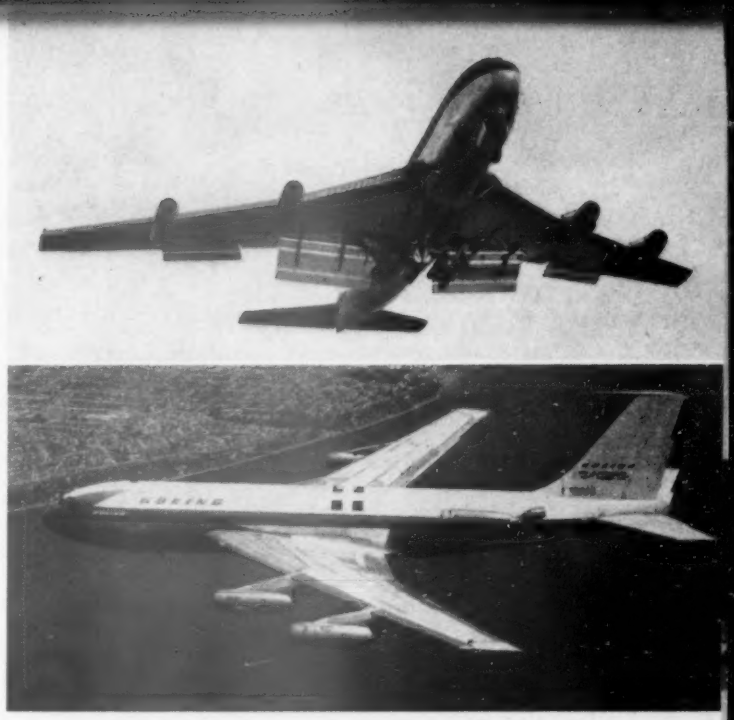
Mr. J. Gilbert, B.E.A. commercial planning manager, gave evidence in support of the contention that the licences, if granted, would divert traffic almost entirely from the corporation. When Mr. Gerald Gardiner, Q.C., for B.U.A., said that the whole history of independent companies was one of going out and finding traffic which B.E.A. could have had, Mr. Gilbert pointed out that B.E.A. had been prevented, by Ministerial policy, from buying any reserve aircraft which could be used for charter operations.

The effect of the applications on B.E.A. aircraft procurement was noted by Mr. Peter W. Brooks, fleet planning manager, who said that if all the licences were granted, 16 of the 24 Tridents on order would be surplus to requirements. Alternatively, older types of aircraft would have to be sold before they were obsolete with equally adverse effects on the financial results. The new £10 million engineering base and other facilities would be under-employed.

Appearing for B.O.A.C., Mr. D. A. Davies referred to the possible impact of granting the new licences upon their own European operations. B.O.A.C. might be required to reduce capacity offered to or through the European cities concerned, or foreign Governments might seek additional traffic rights from the U.K. which would be prejudicial to B.O.A.C. Some examples of B.O.A.C. operations in Europe for 1960/61 were given: on London-Frankfurt-London, there were 17,694 unused seats; on London-Düsseldorf-London the unused capacity was equal to two Viscounts a week, and on the Zurich sector, to three Viscounts a week. On London-Rome-London, B.O.A.C. was not allowed traffic rights on a service within three hours of an equivalent service by Alitalia, and revenue on this sector had fallen by £60,000 since 1958/59 as a result.

B.E.A. concluded the presentation of its general grounds of objection on Jly. 5, and on the following day the hearing entered its second phase with the first of the 72 individual route applications. This was from B.U.A. for two services a day between London (Gatwick) and Paris. It was opposed by B.E.A, B.O.A.C., the British Transport Commission, Skyways, and East Anglian Flying Services. For B.U.A., Mr. D. A. Whybrow said that the fares on this and all their other proposed services would be the same as B.E.A.'s. He thought it was important that the customer should have a choice and said that the public may prefer in five years' time to travel in a smaller aircraft than in a very large one.

The loss in revenue to B.E.A., if the applications were granted in full, would be £410,000 a year, according to Mr. W. R. Collingwood, in charge of commercial agreements for the corporation. He could not envisage another operator being allowed on the route by the French Government without B.E.A. being asked to reduce its share of the capacity.



TRIPLE TESTER.—Now seven years old—the first flight was on Jly. 15, 1954—the Boeing "dash-80" prototype is testing features of the Boeing 727. Seen in these pictures are new high-lift devices including triple-slotted flaps, and a rear-mounted engine to obtain performance and operational data.

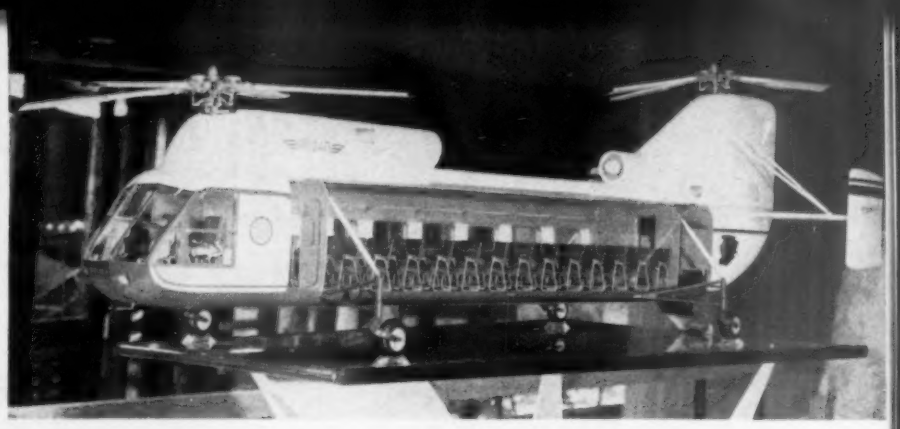
Trooping Contract

BRITISH UNITED AIRWAYS has been awarded the contract for all British Services' trooping between the U.K. and Germany from Oct. 2. From that date, all Servicemen and their families travelling to and from Germany will go by air.

Viscounts are to be used exclusively for this operation, with flights from Gatwick and Manchester to R.A.F. Wildenrath, R.A.F. Gutersloh and the civil airports at Düsseldorf and Langenhagen.

BRITISH AID.—The R.A.E.-developed Visual Glide Slope Indicator (VGSI) was demonstrated recently at La Guardia, New York, by the U.S. licensees, Sylvania Electric Products Inc. Three of the light boxes can be seen in the left foreground of this picture.

Air Transport . . . .



TURBO-COPTER.—Among the several fine aircraft models in the Soviet Trade Exhibition at Earls Court is this one of a new version of the Yak 24P, 39-passenger helicopter, with turboshaft engines in place of the earlier piston units.

Photograph copyright "The Aeroplane and Astronautics"

Rotodynes for the Caribbean?

ACQUISITION of a fleet of five Westland Rotodynes is planned by Indies Air, Inc., a new company in the Caribbean. A letter of intent for five of these rotary-wing airliners has been signed by Indies Air and Kaman Aircraft Corp., the U.S. licensee for the manufacture and sale of the Rotodyne.

Indair, to use the company's operating name, is backed by financiers in Puerto Rico, the U.S. Virgin Islands and the U.S.A. Application has been made to local and federal authorities to operate routes to 15 cities and towns in Puerto Rico and in each of the U.S. and British Virgin Islands. If approval is given for these routes, fixed-wing aircraft will be used at first.

Accidents—The Second Quarter

PRELIMINARY reports indicate a total passenger fatality figure of 173 on scheduled air transport operations in the second quarter of 1961. There were five accidents in which passengers were killed, these claiming the lives also of 32 crew. In another five accidents on non-scheduled and freighting operations, there were six passenger and seven crew fatalities.

These second-quarter statistics are almost the same as those in the first quarter when 173 passengers and 39 crew were killed (see our issue for Apr. 6, 1961) and are rather worse than in the second quarter of 1960, when 126 passengers and 23 crew were killed on scheduled operations and 30 passengers and 36 crew on non-scheduled operations. Taken together, however, the first two quarters of 1961 have a considerably better record than the first half of 1960; allowing also for some increase in passenger-miles, the fatality rate so far this year has probably fallen to somewhere near its pre-1960 level.

The five fatal accidents in the second quarter included one major "big jet" disaster—to the K.L.M. DC-8 (operating on charter to VIASA) which appears to have broken up at about 8,000 ft. after taking off from Lisbon. It was the third fatal accident to a present-generation turbojet in six months, the others being the United DC-8 in collision with a L-1049 over New York in December, 1960, and the Sabena Boeing 707 which crashed near Brussels in February. The worst second-quarter accident was suffered by Air France, when an L-1649 Starliner apparently broke up at 18,000 ft. over the Sahara on May 10, killing 69 passengers and the crew of nine. Other fatal accidents were to a K.L.M. Electra on the approach to Cairo, and to a DC-3 and a C-46 in South America.

Whilst the picture is thus not quite so black this year so far as passenger safety is concerned, there have again been a number of expensive non-fatal accidents. Notable among these was the loss of a DC-8 by Japan Air Lines when it overran the runway while landing at Tokyo (perhaps on account of aqua-planing—see below) and broke its back. A Boeing 707 of Air France was badly burnt in a landing incident at Lisbon and may also be beyond repair. An S.A.S. DC-7C was burnt out at Khartoum after it had been hit by another aircraft, and among other airline aircraft totally destroyed during the quarter were a DC-4, two DC-3s and a Sikorsky S-58.

An Aqua-planing Accident

THE phenomenon of "aqua-planing," in which an aircraft can ride down a wet runway supported on a film of water with the effectiveness of the wheel brakes reduced virtually to zero, has only recently become widely known and experimentally demonstrated. Even now the precise conditions under which aqua-planing occurs are not fully understood and research is continuing in the U.K., the U.S. and elsewhere. It is known that the phenomenon is related to aircraft speed and probably to depth of water on the runway. At high speeds, pressure is exerted at any single point on the water film for so short a time by the tyre contact area that the tyre never comes into contact with the runway at all.

Aqua-planing has been rumoured as a factor in several landing accidents to the larger jet aircraft. There was, for example, an instance experienced by K.L.M. at Schipol very soon after the first DC-8 had been delivered, without serious consequence; and the loss of a DC-8 by Japan Air Lines at Tokyo earlier this year has also been attributed, by some reports, to aqua-planing. But it is not only the big jets, with their very high touchdown speeds, which are vulnerable, as a report on the accident to a Handley Page Hermes at Southend Airport published last week, shows.

This report, issued by the Ministry of Aviation following a private investigation is, we believe, the first by any official body to isolate aqua-planing as the cause of an accident. The incident occurred on Oct. 9, 1960, to a Hermes 4 of Falcon Airways landing at Southend on a flight from Barcelona. The aircraft ran off the end of the runway, struck an earth bank and came to rest partially on a railway line. None of the 71 passengers was seriously injured (all, incidentally, were in rearward-facing seats—see page 35 of this issue).

In the investigation, it was established that the aircraft was properly maintained and operated and that the brakes were serviceable and capable of achieving the design braking force. The accident occurred because "the coefficient of friction between the main wheel tyres and the runway during part of the landing run was very low due to aqua-planing."

Sequence of Events

The landing was made on Runway 06, which is 5,265 ft. long (effectively 5,140 ft. because of displacement of the threshold) and has a surface of hot-rolled gravel asphalt. The Hermes is certificated with no "performance group classification," and is therefore required to have a landing run from 50 ft. of not more than 70% of the available distance. Flight manual data for the estimated landing weight of 74,600 lb. indicated the approach speed (1.2 Vso) to be 115 knots and the landing distance required by the aircraft was then almost exactly 70% of that available.

At 3 naut. miles from touchdown the aircraft's speed was about 135 knots, wheels down and locked and flaps down 20 degrees. The weather was given as "visibility 2 n.m., continuous slight rain," but witnesses said the rainfall was moderate to heavy when the aircraft landed. Full flap was applied when the runway approach lighting was sighted, about 2 n.m. from touchdown. The threshold was crossed at an estimated 15 ft. and 115 knots, and the throttles were closed. Touchdown was about 600 ft. beyond the threshold markings at between 105 and 110 knots and the nosewheel was lowered on to the runway 4 to 5 seconds later.

The wheel brakes were then applied, but after 6 or 7 seconds the captain realized they were having little effect, released them in case the wheels had locked and then applied them again. Pressure gauge indications were normal but there was no noticeable braking effect. The captain tried to turn the aircraft, using nosewheel steering, at the end of the runway, but although the heading was changed the direction of travel was only slightly altered and the aircraft skidded off the runway.

Tyre marks became visible on the runway about 560 ft. from the end, where the aircraft started to turn and skid. The tyres were found to be in good condition apart from one local area of scalding (blistering of the rubber) and one local area of scoring on each. Scalding, according to the report, can only occur when the wheels have been locked with a film of moisture between the tyre and the runway.

Tests were made on the runway, with an average water depth of 0.05 in., using a small braking force trailer to measure the braking force coefficient at various speeds. On each run the wheel was locked for 2-3 seconds. At 80 m.p.h. the coefficient was 0.17, compared with values as high as 0.8 which are obtained on dry runways and a mean value of 0.33 on runways where there is no knowledge of trouble caused by slipperiness in wet weather.

Aircraft tests conducted by the Ministry of Aviation (with a Swift jet fighter) show that the coefficient of friction falls with increase of forward speed, for example from 0.5 at 10 knots to 0.1 at 100 knots, with a tendency to remain constant thereafter. It is argued that the tyre is fully aqua-planing at about this speed, as there is no significant change in the coefficient of braking at higher speeds.

Now in service

DART

Herald

Handley Page's jet-prop airliner for everyone

—everywhere

The Folland Lightweight fully-automatic Ejection Seat, Mark 4, is standard equipment for the Gnat Trainer which is now in quantity production for the Royal Air Force. The parachute equipment is manufactured and has been developed by the G. Q. Parachute Company in conjunction with and to the specification of Folland Aircraft Limited.

G.Q. LEADERS IN PARACHUTE DEVELOPMENT

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Air Transport . . . .

Rear-facing Seats Discussed

A WIDE divergence of views on the question of rearward-facing seats for transport aircraft was disclosed at a recent conference on the subject held by the Federal Aviation Agency. The principal protagonist of rearward seating at the conference was the Armed Forces Institute of Pathology, on the grounds that in most accidents aircraft crashed in a forward direction, exposing passengers to very high deceleration forces. A survey of 10,000 military passengers showed only 3% objecting to rearward-facing seats—but this survey was challenged by the airlines because the questionnaire was "loaded" by beginning "in view of the safety advantages of aft-facing seats, would you object. . . ."

The Air Transport Association said there was evidence that rear-facing seats could be more dangerous in some crashes than conventional seats. A NASA spokesman said that seat direction did not appear to be a major solution, and the Aerospace Industries Association, whilst supporting further research, doubted that rear-facing seats offered any real increase in safety. The Airline Pilots' Association wanted money spent on improving airports and landing aids rather than reversing the seats in aircraft.

A study by Cornell University was quoted by one airline spokesman, showing that the strength of seat floor attachments and seat belts was more important than seat direction; that seat direction appeared to have little importance in crashes in which there were survivors, and that side or rearward directional forces occurred in some crashes, making rearward-facing seats more dangerous than forward-facing.

Lockheed Aircraft Corp. estimated that reversing seats in current aircraft types would add 5-10 lb. per seat because stronger floor attachments were needed. Over 10 years, this could add nearly £1 million to the operating cost of a single aircraft.

The Tu-114 in Service

FURTHER details of the Tupolev Tu-114 have been given in the Russian Press. Three variants are reported the basic one is that now used on the Moscow-Khabarovsk route, which has seats for 170 passengers; an intercontinental version has 120 seats; and a short-range version has 220 seats.

The example exhibited as the lone Russian entry at the Paris Aero Show (bearing the number CCCP 76470) apparently was an intercontinental version, although it actually had 147 seats in all. From the rear entrance of the aircraft (reached, in Paris, by way of a precariously perched ladder atop some more conventional aircraft loading steps) one entered a cabin containing nine rows of seats, in triple units on each side of the aisle. Cabin signs—"No Smoking," "Fasten Belts" and "Put on Oxygen Masks"—were in Russian and English, and the oxygen masks themselves appeared to be stowed in boxes integral with the luggage racks, which would have looked more at home in an elderly Pullman rail car than in an aircraft in 1961. Individual reading lights were in the back of each seat, but there were no individual passenger ventilation or steward call buttons.

Passing forward, one came to four individual cabins, two on each side, and each containing six seats (face-to-face) and a retractable bunk. Next came the two steps up over the wing spar box, a galley, a staircase down to the "kitchen" below decks, and an individual cabin with three seats and a baby's cot. Then two steps down into a 24-seat cabin with triple seats face-to-face about four tables. This apparently is the "restaurant" for feeding in relays, there being no provision for trays attached to the seat backs. Forward again, beyond some wardrobe space, was a 42-seat cabin, with seven rows six abreast. Toilets were at the rear and forward.

For servicing, the aircraft is, according to Aeroflot practice, divided into sections with separate teams working on each section during each shift. There are 15 sections, as follows (the number of technicians on each section being shown in brackets, and including men for checking defects and for routine preparations): front part of fuselage (5); nose wheel (3); central fuselage (8); rear fuselage (4); tail section (4); port centre section (8); port outer wing section (5); No. 1 engine (5); No. 2 engine (5); port undercarriage (6); starboard undercarriage (6); No. 3 engine (5); No. 4 engine (5); starboard outer wing section (5); and starboard centre section (8).

The main systems are divided into the following groups: powerplants; airframe and fuel system; flying controls and flap controls; undercarriage, hydraulics and compressed air; pressurization, toilet, water systems, electrical; instruments, oxygen and fire extinguishers; and radio.

There are five systems covered in the pre-flight and post-flight tarmac inspections. The organization of maintenance is such that, after preliminary work outside, the aircraft is brought into a dock in the hangar. All processes in the dock are mechanized so far as possible: raising the aircraft; removal of engines, radar and accumulators; removal and fitting of flaps; removal and replacement of wheels; inspection and cleaning of filters; greasing, and so on. The dock is supplied with compressed air, electrical power, light and the necessary power tools.

Photograph copyright "The Aeroplane and Astronautics"

AWARD WINNERS.—Capt. A. L. French, of B.E.A. (left) and Capt. E. H. Jones of B.O.A.C. were presented with briefcases, on Jly. 4, as their 1961 Meteorological Office Awards for outstanding service in providing weather reports. The presentations were made by Dr. A. C. Best (centre).

Viscounts Still Selling

THREE more Vickers Viscounts will be ordered by Mitsui and Company for use by All Nippon Airways, to make a total fleet of nine. This was stated by the company early last month, when the first Viscount 828 was handed over at Wisley. Already, the order for six of these aircraft is Britain's largest aircraft export to Japan, worth over £4 million with spares. The first aircraft left Hurn on delivery to Tokyo on Jne. 22.

The Viscount 828 is an 810 variant equipped generally to U.S. standards. Designed for two-crew operation, it has Bendix weather radar, Sperry integrated flight system, a Bendix auto-pilot, Bendix ADF and Collins HF and VHF radio. The cabin is divided in two, with eight first-class seats forward and 55 in the main tourist cabin. The four-seat rear lounge can be used if necessary to increase the total capacity to 67. Airstairs are fitted.

Viscounts are at present in production at Weybridge and Hurn for Germany, Ghana and Japan; 429 have been sold.

Helicopters for B.E.A.

THERE is still no news of any positive steps being taken towards the introduction of regular helicopter services by B.E.A. Recently, at Question Time in the House of Commons, Capt. G. R. Chetwynd (Lab., Stockton-on-Tees) asked the Minister of Aviation whether he had approved British European Airways' purchase of Boeing-Vertol 107 helicopters; how many were being bought; and when and on what routes he anticipated a helicopter service?

In reply the Minister's Parliamentary Secretary, Mr. Geoffrey Rippon, said that B.E.A. and Sabena were discussing the possibility of introducing joint cross-Channel services. Further work, he said, needs to be done before any scheme could be approved. But he went on: "Progress so far gives us cause for optimism."

According to reports, the two airlines' plans cover a service linking London, Paris and Brussels. Six helicopters have been mentioned as the required size of the fleet concerned, at a cost of £250,000 each. And the de Havilland Gnome shaft turbine engine has been suggested as the likely powerplant for these craft.

The Fighting Services

Air Rank Promotions

IN the half-yearly promotion list which took effect this month the Air Ministry anounced the following air rank promotions.

Air Vice-Marshals Sir Kenneth Cross and Sir Leslie Dalton-Morris have been promoted to the rank of Air Marshal. Air Commodores P. T. Philpott, F. E. Rosier, E. G. Jones and D. F. Spotswood have all been promoted to the rank of Air Vice-Marshal.

Group Captains F. J. Manning, B. P. Young, W. Pitt-Brown, R. E. Craven, C. N. Foxley-Norris, D. G. Smallwood, J. Barraclough, P. C. Fletcher, T. E. J. Fitton, F. E. Tyndall, S. W. Lane, K. T. Nicklin, G. L. Seabrook, K. W. Godfrey, R. L. Soper, R. C. Jackson, E. S. Sidey, A. Muir and E. B. Harvey have all been promoted to the rank of Air Commodore.

Middle East Appointment

AIR VICE-MARSHAL F. E. ROSIER, C.B., C.B.E., D.S.O., is to become Air Officer Commanding, Air Forces Middle East (Aden), in August.

Director of Plans to the Chief of the Defence Staff and chairman of the Joint Planning Staff, Ministry of Defence, he was previously Director of Plans at the Air Ministry. He directed the Service Exercise "Prospect" in 1958.

Air Vice-Marshal Rosier joined the R.A.F. in 1935. During the War he served with No. 229 Squadron and subsequently commanded No. 262 Wing in the Western Desert. He commanded R.A.F. Northolt in 1944 and R.A.F. Horsham St. Faith in 1947. After a spell in America with the Air Defence Command there, he served on the directing staff of the Joint Services Staff College; was Group Captain, Flying, at the C.F.E.; and Group Captain, Plans, at Fighter Command H.Q.

New Naval Helicopter Squadron

A NEW Royal Naval air squadron was scheduled to be commissioned at R.N. Helicopter Station, Portland, last Tuesday, Jly. 11, with four different types of helicopters—Wessex, Whirlwind, Dragonfly and P.531. Known as No. 771 Helicopter Training and Trials Squadron and commanded by Lieut. Cdr. A. I. R. Shaw, M.B.E., R.N., it is the first Fleet Air Arm squadron to be specifically commissioned and equipped for a training and trials task.

Officers who planned to attend the commissioning ceremony included the Flag Officer Sea Training, Vice-Admiral P. W. Gretton, C.B., D.S.O., O.B.E., D.S.C., R.N., and the Flag Officer Flying Training, Rear Admiral F. H. E. Hopkins, C.B., D.S.O., D.S.C., R.N.

F.A.A. Promotions

INCLUDED in the half-yearly list of provisional Royal Navy promotions to date from Dec. 31, 1961, are the following Fleet Air Arm officers and officers in aircraft carriers or air establishments.

Commander K. Lee-White, H.M.S. "Terror," and Cdr. P. M. Austin, Admiralty, are to be promoted to the rank of Captain.

HELICOPTER SOLO.—Air Cdre. G. C. Hartnell, C.O., of R.A.A.F. Butterworth, Malaya, being congratulated by Sqn. Ldr. C. Simons, C.O., No. 110 Squadron, after his first solo in a R.A.F. Sycamore. Air Cdre. Hartnell is probably the first R.A.A.F. air officer to solo and fly regularly in helicopters.

Lieutenant Commanders J. A. Thackwell, H.M.S. "Ark Royal"; D. C. Matthews, Air Organization and Training Department, Admiralty; P. J. Edwards, H.M.S. "Falcon" (Obs. School); W. A. Tofts, H.M.S. "Fulmar"; H. E. R. Bain, H.M.S. "Heron," on staff of F.O.F.T.; D. P. Norman, H.M.S. "Fulmar"; T. V. G. Binney, C.O., No. 804 Squadron, H.M.S. "Hermes"; M. P. Dawes, H.M.S. "Victorious"; J. D. Baker, Admiralty; G. D. H. Sample, H.M.Y. "Britannia"; and J. A. Beadon, Ministry of Aviation, are to be promoted to the rank of Commander.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. P. J. Cundy, D.S.O., D.F.C., A.F.C., T.D., and Wg. Cdr. P. L. Parrott, D.F.C., A.F.C., to the Department of the Chief of the Air Staff; Wg. Cdr. R. M. W. Henderson to the Department of the Air Member for Supply and Organization.

Fighter Command: Wg. Cdr. R. E. Gardiner, D.F.C., to R.A.F. Leuchars to command No. 29 Squadron; Sqn. Ldr. A. F. Jenkins to Headquarters for air operations duties with acting rank of Wg. Cdr.

Coastal Command: Wg. Cdr. F. G. B. Randall to R.A.F. Ballykelly as Senior Technical Officer; Sqn. Ldr. A. F. Carvosso to R.A.F. Ballykelly to command the Flying Wing, with acting rank of Wg. Cdr.

Flying Training Command: Wg. Cdr. N. J. Carver to the R.A.F. Staff College, Bracknell, for directing staff duties; Wg. Cdr. N. A. Sellars to the R.A.F. Flying College, Manby, for instructional duties.

Technical Training Command: Wg. Cdr. W. H. Coast, O.B.E., to No. 4 School of Technical Training, R.A.F. St. Athan, to command the Technical Wing.

R.A.F. Germany: Wg. Cdr. G. N. Street, O.B.E., to Headquarters as Command Movements Officer; Wg. Cdr. S. Slater, D.S.O., O.B.E., D.F.C., to R.A.F. Bruggen to command No. 213 Squadron.

Other Appointments: Wg. Cdr. W. G. Lydan to the Supply Control Centre, R.A.F. Hendon, for systems analysis duties; Wg. Cdr. J. P. Spillane, O.B.E., to the British Defence Staffs, Washington.

More Service News

R.A.F. Benevolent Fund.—The 41st annual report of the Benevolent Fund for 1960 reveals that £527,979 was spent during the year on relieving distress or need. During the same period the total of subscriptions and donations received from all sources was £369,188, representing 60% of total relief expenditure.

Honorary Physician.—Air Vice-Marshal S. R. C. Nelson, O.B.E., M.D., M.C.P. & S., has been appointed Honorary Physician to H.M. the Queen. He has been Principal Medical Officer, Bomber Command, since October, 1959.

ARMY SUPPORT.—A total of 19 R.A.F. squadrons are taking part in direct support of the Kuwait operations, including Nos. 8 and 208 equipped with Hunter FGA.9s. Here, some of these ground-attack fighters are being armed with 60-lb. rockets at Farwania airstrip, Kuwait.

Reliability for the Royal Air Force—

Dunlop tyres, wheels and brakes are standard equipment on the English Electric Lightning all-weather day and night interceptor now in service with the Royal Air Force. The braking system incorporates Dunlop Maxaret anti-skid units; and many components in the weapons system are also supplied by Dunlop.

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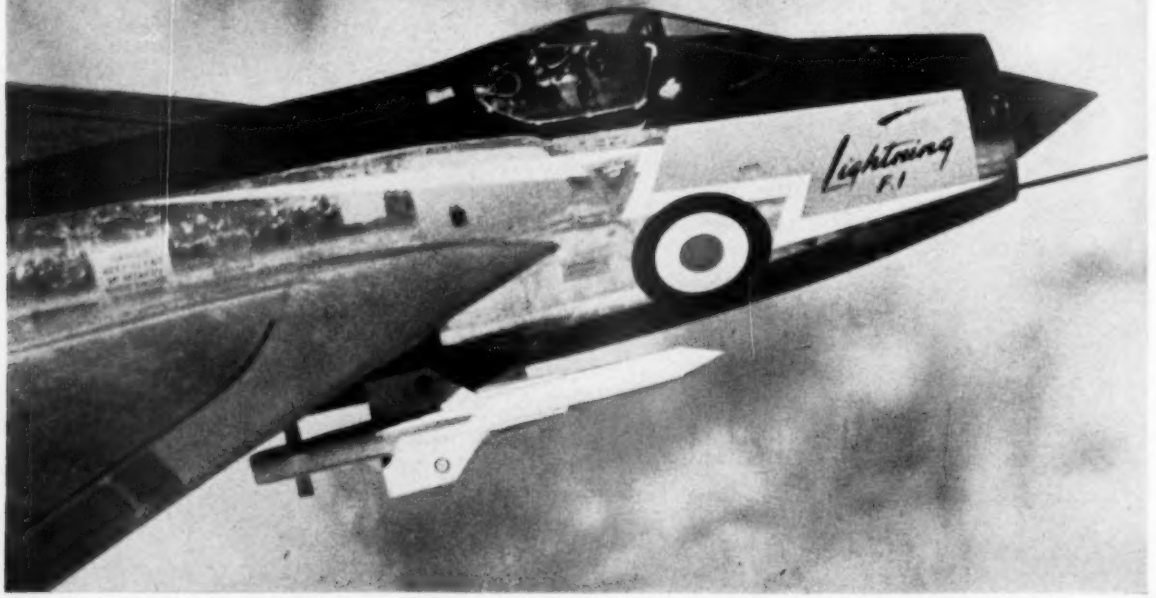

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Aeroflot Equipment

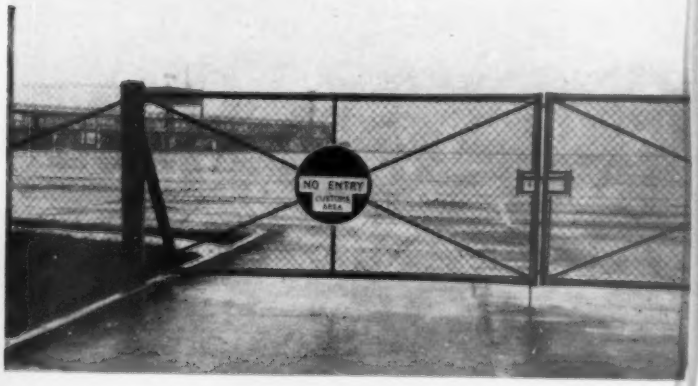
Above, helicopters are reported in use on many domestic routes in Russia, presumably on heavily subsidized operations. This Mi-4 is leaving a heliport in Lenin Square, Baku, (Azerbaijan), for the airport outside the city.

Above, a new illustration of the Tupolev Tu-124, a short-haul derivative of the Tu-104 powered by Soloviev turbofan engines and expected to be in service with Aeroflot later this year.

Right, the Antonov An-14 is said to be now ready for service after a lengthy development period in the course of which the tail unit has undergone some modification. It is intended for taxi and feeder operations.

Left, all the newest Russian airliners are seen together in this picture. In the foreground, left to right, are the An-10A, An-14 and An-24, and the Mi-4 helicopter. In the farther line-up are the Tu-104 (with a Tu-114 beyond it), the Tu-124 and four Il-18s, including one in Ghana Airways markings.

Controlling the Customers



A collection of self-explanatory negative directives photographed recently at London's Gatwick Airport by Peter Masefield.

Europe and Space—2

Last week we gave a preliminary report on the affairs of the first Symposium on Space Technology organized by the British Interplanetary Society in London on Jne. 26-28. Here we continue our account of these proceedings which, of course, were held before the agreement regarding Blue Streak was made known. Details of this agreement are given elsewhere in this issue.

THE third day of the European Symposium on Space Technology was devoted to an exchange of ideas concerning the possible foundation of what MR. A. V. CLEAVER (Rolls-Royce, Ltd.) described as ESLO, the European Space Launcher Organization. He hoped this would soon take its place alongside ESRO (the European Space Research Organization) which was being formed to co-ordinate work on satellite and space-probe research payloads.

Arguments which have been put up against European nations having their own space programmes, Mr. Cleaver said, were that we cannot afford one, that we were too late in entering the field, and that there was no point in repeating work already being undertaken in the United States and Russia. In his opinion, these arguments would be even more compelling in the future; we must therefore get in *now*.

Although Britain and France should be able to afford the initial stages of a space programme, it was unlikely that they could afford the subsequent developments which must be undertaken to make such a venture worthwhile. But Western Europe as a whole could afford this, and indeed if such a programme were not taken up, it would mean that some 300m. members of mankind had opted out of the entire future of space technology.

The consequences of this would be particularly marked after Europe's long history of specialist contributions to Western civilization and the rise of science and technology. Our highly developed industries and research establishments are all potentially capable of making contributions to this exciting field, he said. And co-operation in Europe would be a step towards co-operation throughout the World.

In his paper on "New Aerospace Technologies," M. F. VINSONNEAU (SEREB) thought it desirable that Europe became a Space Power at a corresponding level to its intellectual and economic capacities. We do not want to compete with our American allies, he said, but to be one of the major partners in the competition between East and West. This goal can only be reached if all European forces are closely united; the first test of the measure of our success is to obtain from our governments financial support, the total of which must reach a certain level. In this programme, advanced technologies are of prime importance; to acquire and hold them would truly qualify Europe as an economic Power in the World of the future.

Before being European we were Franco-British, Vinsonneau continued, and no one will hold it against us. Hawker Siddeley and SEREB, linked only by their goodwill, had published a study on "Industry and Space" which showed, down to the last detail, such a desire for united action that even the severest critics of this aim were silenced. We have said that we want to enlarge this understanding to other countries and other industries.

In another direction, we have supported the plan for a heavy launcher based on Blue Streak. We have not pretended, either at home or to our friends abroad, that this is the only solution technically or economically possible; it is doubtful if we should have sounded very convincing. But what we did say, and repeat with conviction, was that once we believed that the only solution in this field was a united Europe, the experiences and methods gained by the United Kingdom formed a large part of our common fund of knowledge and it would be our duty to support them and to prevent their dispersal.

Political and Economic Factors

In a comprehensive document outlining the political and economic implications of a European Space Programme, MR. DAVID PRICE, M.P., said he would not argue, as some European scientists had done, that the cost of entering upon a space programme would be intolerable on a purely national basis for the larger European countries (i.e., Britain and France). If the peoples of our countries were so minded, he said, the cost of a modest, but still significant, programme costing up to £25m. p.a. would be perfectly containable within our gross national products.

However, such programmes could only be modest compared with the Russian and American programmes. The consequential opportunities to exploit emergent possibilities for major technological break-throughs might necessarily be restricted by lack of resources. This was an important factor.

It had been argued, Mr. Price continued, that European countries, either individually or collectively, would be very ill-advised to attempt an independent space programme because such a programme implies the development of the necessary rocket vehicle to launch its satellites or space-probes. This would be very costly to develop and a needless duplication of American and Russian work on space vehicles and rocket systems. Such opinions had been widespread.

Mr. Price said he was of the firm opinion that if Europe was to conduct its own space programme, Europe must have its own vehicle. Riding into space on an American vehicle would be a very poor "second best," though it would be better than doing nothing. The point was—and this could not be emphasized too strongly—that most of the technological and economic benefits of a space programme flow from actually developing a space vehicle and its propulsion system.

An independent European programme does not exclude scientific co-operation with the United States and the U.S.S.R. A number of European tracking stations have been assisting these two countries in plotting the courses of their satellites and space probes. "In my view," said Mr. Price, "long-term co-operation can be better effected by Europe having its own independent space programme than waiting expectantly and pathetically for the 'space crumbs' which may fall from the rich man's table."

Defining the Programme

"A Ten Year Programme of Space Technology" was the subject of an interesting paper by DR. L. R. SHEPHERD, the former president of the British Interplanetary Society. In his view, attention should not only be given to satellites and space probes, but also to small instrument payloads for landing on the Moon. These, he said, already figure prominently in the American programme and there are good reasons for including them in the later stages of a 10-year European programme.

On the question of commercial applications, it may be said that in such an expensive enterprise as space exploration it is of obvious importance to pay due attention to those applications which will lead to a valuable commercial reward. However, it is always important not to do this at the expense of the broader, longer term, objectives which may hide, unforeseen, much more valuable prizes. In the course of a 10-year programme, one would expect to be able to set up a commercial network of communication satellites which would begin to bring in revenue and contribute usefully to World communications.

Manned spaceflight, Dr. Shepherd went on, is ultimately the most important outcome of all our astronautical endeavours and, if it did not figure prominently in a European programme, the latter would have no real purpose. Man in space demands large launching vehicles, and it would not be until the later stages of the 10-year plan that serious orbital operations could be contemplated.

However, sub-orbital flights by manned capsules would certainly be possible even with the presently proposed European launching vehicle, and these would be valuable in training "astronauts" and gaining experience for later true space operations. Some launching vehicles should be earmarked for this purpose, the necessary re-entry vehicle developed, and supporting work in space-medicine and crew training should be included in the programme.

The cost of a programme as ambitious as the one outlined, Dr. Shepherd said, would not be negligible. It was hardly likely that it could be accomplished, over the period in question, for an average expenditure of less than £50m. p.a. Several projects based upon different centres in Europe and launching sites elsewhere in the World—for example, North Africa and Australia—would be involved.

In the opinion of the lecturer, the proper procedure would be to set up, possibly under O.E.E.C., a European Space Development Agency. The first task of such an Agency would be to divide the work into a number of projects and development areas, and to allocate each of these to a centre in one of the participating countries. The centres could be existing

(*Continued on page 41*)

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M-B A

(*Continued from page 40*)

national research establishments which would become internationalized in the sense that they would open their gates to staff from any of the other countries. Obviously, Dr. Shepherd said, a fair distribution of the various projects would be made throughout the participating countries, and contracts should be placed on an international basis.

The question would arise as to the respective rôles and responsibilities of the European Space Development Agency and the various centres involved in the programme. While there is some scope for variation of the respective responsibilities, the most workable arrangement would be to give each centre full responsibility for the conduct of the work in its own project or area including the financial, and the contractual actions which would have to be taken.

The Agency would not itself exercise any close technical control, nor would it intervene in the day-to-day administration of the work at any centre. It would be represented on the international managerial committees which, inevitably, would be involved in all projects and would otherwise be responsible for planning the overall programme.

Once a project had been started at a given centre, it should be allowed to proceed without interruption over an agreed period (say five years), with an agreed budget for the whole period. Obviously, Dr. Shepherd concluded, it should not be forced to proceed on the basis of an uncertain budget covering only short intervals with no guaranteed continuity.

The main points in Dr. Shepherd's 10-year (1961-71) European Space Programme are as follows:—

A. Vehicle Projects

1. Phase 1 launching vehicle (the presently proposed project based upon Blue Streak).

2. Phase 1a launching vehicle, utilizing higher energy propellents (i.e., liquid hydrogen/lox.) in upper stages to increase payload capacity, but with same first stage as Phase 1 vehicle.

3. Phase 2 launching vehicle, capable of placing 10,000 kg. in a close orbit, based entirely on high energy-propellent stages, possibly with 500,000 kg. total thrust cluster of liquid hydrogen/lox engines in first stage.

Associated with these three main projects there would be the development of a small number of appropriate upper stages, some of them interchangeable between the three vehicles listed.

B. Applications

1. Instrument-carrying satellites and space probes for space research, utilizing Phase 1 and, in later stages, Phase 1a vehicles.

2. Soft-landing instrumented lunar probe utilizing Phase 1a vehicle.

3. Close and synchronous-orbit communications satellites. Series of launchings and tests leading to commercial use by about 1970; utilizing Phase 1 and 1a vehicles.

4. Development of manned capsule or re-entry vehicle and its use with the Phase 1 vehicle for sub-orbital flight.

C. Research and Development

1. Full supporting research and development in all relevant areas connected with the projects and applications listed above.

2. Longer-term research and development, particularly on advanced propulsion systems that might be used in a second 10-year European programme, e.g., in nuclear propulsion.

The total cost of the above programme might amount to £500m., of which more than half would be associated with the vehicle and its associated research and development.

The Launching Site

On the subject of "Australian Contributions to a European Space Programme," Mr. H. J. Higgs (W.R.E. representative) said that the first and most valuable contribution that Australia offers to Europe is the use for space purposes of another continent whose character is almost the ideal complement to Europe. In Europe, he said, one has all the resources in science, technology, manpower and economic margins that are a necessary condition before a space proposition can be contemplated. In Australia there is adequate two dimensional space for launching sites and their associated facilities and hazards. "Moreover, our continent is antipodal to yours."

Thus, in combination, we can look out into space from both sides of the planet and, also, for all launching directions, Earth orbits in their first pass will converge at the antipodes, i.e., near Europe.

Emphasizing the importance of making maximum use of existing resources, Mr. Higgs pointed out that the Australian Government from its own budget has so far contributed £80m. sterling to the development of the Woomera range and supporting facilities. This does not include the substantial separate expenditure by the U.K. Government on its missile contracts for the preparation in Australia of missiles for firing or the considerable additional funds and equipment provided by the United Kingdom and the United States for special range services.

It is very difficult, Mr. Higgs said, to determine the actual value of capital facilities (even excluding real estate) that could be made available to Europe but some inferences might be drawn from rough estimates for a new equatorial site for "operational" launchings of communication satellites by the Blue Streak vehicle, which are between £20m. and £40m. sterling, depending on the state of development of the site. Such a site would exclude all the research and development facilities and instrumentation that are available at Woomera which might, in fact, be worth as much again.

Mr. Price's paper has shown, Mr. Higgs continued, that the future expenditure for the proposed European heavy satellite launcher, based on Blue Streak, is estimated at £70m. sterling in addition to the £60m. that has already been spent in developing this vehicle. To all this must be added the use of Woomera which represents the use of capital facilities directly applicable to space activity of something between £30m. and £60m. sterling, depending on the number of existing facilities actually required in this rôle.

However, Woomera is not just capital. It is a considerable working "machine" with a considerable human investment in skills and capabilities in a rare category to operate that machine. The staff, in fact, totals in excess of 4,000 scientific, technical and support grades. Further, this is organized on an essentially civilian basis—apart from Service flying activities—through the Australian Department of Supply.

Mr. Higgs stressed the difficulties of establishing similar launching facilities on a deserted tropical island. He suggested that the finance authorities would look very quizzically at the "dead end" expenditures of such vast amounts to develop a new site of this kind when a site already exists that requires only relatively minor development. They might think the money would be better spent in the laboratories and workshops of Europe building better rockets.*

These arguments were amply reinforced by a colour-film on Woomera recently completed by the Weapons Research Establishment in Australia under the title "Trials Facilities." This showed in detail the extent to which the Woomera range has been developed in recent years, including the wide range of tracking, recording and data-reducing equipment and the large amount of equipment which has been installed in support of American space-programmes (in particular the 85-ft. diameter tracking antennae for deep-space probes, and the ground tracking and communication facilities for the Mercury man-in-space project).—K.W.G.

(*More Astronautics news is on page 52*)

West Germany's agreement to join Britain and France in developing a European space-booster, announced soon after the Symposium closed, may see the first test-firing of the basic Blue Streak component from this site at Woomera next year.

Lightnings for the Royal Air Force

Photograph copyright "The Aeroplane and Astronautics"

WHEN the then Chief of the Air Staff was called upon formally to name the English Electric Lightning—up to that time known only by the somewhat uninspiring designation of P.1B—he roundly declared his confidence that in it the Royal Air Force had a winner. The close co-operation that had been built up between the English Electric, Rolls-Royce, Ferranti and de Havilland Propeller companies in developing the machine had resulted, he said, in a weapons system that would be second to none in the World.

That ceremony took place at Farnborough some 2½ years ago. Since then the development of the Lightning has proceeded according to programme and all the indications are that the C.A.S.'s confidence was more than justified.

The R.A.F.'s new supersonic fighter—which is powered by two Rolls-Royce Avons with reheat, armed with de Havilland Firestreak air-to-air infra-red target-seeking missiles and equipped with the Ferranti Airpass fire-control system—has now been firmly established in operational service. More recently it has been seen in such public places as the French *Salon de l'Aéronautique* at Le Bourget, where No. 74 Squadron's aircraft produced one of the highlights of the flying display.

Having been given details of the Service operation of the Lightning (see THE AEROPLANE AND ASTRONAUTICS for Feb. 24), it is now possible for us to show the structural and other internal features of this remarkable aeroplane in some detail. This we have chosen to do in cut-away drawing form on both sides of a three-page pull-out which follows these notes. On those pages will be found what we believe to be the most detailed drawing to be made of any front-line military aircraft at such an early stage of its Service career.

With the release of this technical information from the company has come some details of the production arrangements that have been made. No details of the quantities being built have been disclosed—for obvious reasons—but it can now be said that three factories are involved in this production effort and that a total work-force of 8,000 is engaged on the whole of the English Electric aircraft production programme.

Wings and front fuselages are made at the company's Preston works; the main fuselage and the tail surfaces are constructed at Accrington; and the final assembly line is at the English Electric Samlesbury establishment. The completed aircraft make their initial flight from the aerodrome at Samlesbury and are flown straight to the company's main aerodrome at Warton where all test flying is done.

The Ministry of Supply's first order for Lightnings introduced a welcome breakaway from the established practice of ordering only two or three prototypes of a new type. It had been found that the limited amount of development flying that was possible with so small a number of available aircraft was a potential source of serious delays in getting new aircraft into service. In the case of an aircraft as complex as this new supersonic fighter/weapons-system, the delay problem was likely to be even more acute than with earlier types. And so it had been decided to introduce a system of ordering a sizeable batch of "pre-production" aircraft with which the various development programmes could proceed more or less concurrently.

Thus, 20 pre-production Lightnings were ordered in 1954. The first of these flew for the first time in April, 1958; five more were flown by the end of that year; and all 20 were finished by September, 1959. The first production aircraft proper came off the assembly line in October, 1960.

Naturally enough, the complexity of the Lightning as a weapons system has introduced a number of production problems relating to the final and sub-assembly line techniques; and there is an inevitable tendency towards costliness in terms of man-hours. The front fuselage, for example, although physically large, is not big enough for more than one man to work in when the cockpit equipment, radar, armament and flying aids that it contains, are being installed.

So far as the airframe itself is concerned, considerable attention has been paid to the structural design to ensure that wherever possible, existing tools and current methods can be used. Nevertheless, a supersonic airframe cannot be expected to be entirely conventional and some new techniques—such as the use of skin routing, titanium forming, and the use of stainless steel—have been found necessary.

The production programme as a whole was planned so that any modifications found necessary during the development flying with the 20 pre-production aircraft could be introduced along the line without disrupting the flow and before the production aircraft reached the flight stage. In point of fact, although a number of minor modifications has been introduced in this way only one major change, according to English Electric, was found to be necessary.

This was the introduction of a 30% larger fin—the need for which had been established in wind-tunnel tests made before the first flight of the Lightning prototype and subsequently confirmed in the air. Once the necessity for this larger fin was finally agreed units were put into production for retrospective installation on all aircraft.

The Lightning F.1 now in squadron service with the R.A.F. has a background of extensive research and development. Its history can really be traced back to 1949 when the English Electric project design team under Mr. W. E. W. Petter were working on a research aircraft to a Ministry of Supply specification. From the start, however, in this design provision was made for carrying armament and other equipment essential to an operational type.

When Mr. Petter left English Electric to go to Follands work on the project continued under Mr. F. W. Page, C.B.E., M.A., F.R.Ae.S. (now a director and chief executive of the aircraft division of English Electric Aviation, Ltd.). The project became known as the P.1.

At a fairly early stage in the development of the design it was decided to go beyond the wind-tunnel and to do some full-scale flight research into the handling characteristics of a highly swept aircraft. To this end, in collaboration with English Electric, Short Brothers and Harland built the SB.5 research aeroplane which was a near-scale model of the P.1 powered by a single Rolls-Royce Derwent.

The layout of this aircraft was such that it could have its wing swept to 50°, 60° or 69° and its tailplane mounted in the high, low or mid positions. This research aeroplane first flew in December, 1952, and started a flight test programme that was to provide an immense amount of extremely useful data on aircraft configuration and swept-wing characteristics.

The prototype of English Electric's so-called research aircraft, by that time known as the P.1A and the real forerunner to the Lightning, made its maiden flight in August, 1954, powered by Armstrong Siddeley Sapphire turbojets. Two of these aircraft were built and flown intensively.

In April, 1957, however, a new version of this aircraft, designated P.1B and powered by two Rolls-Royce Avons with reheat, made its first flight. This new version was generally similar to its predecessor but was notable in having a circular nose intake with a distinctively large centre-body, or bullet, which was clearly capable of housing radar equipment. Other minor differences included a new canopy to give improved view and a revised air-brake location near the fin leading-edge instead of near the tail.

Apart from the intensive programme of flight development trials with the 20 pre-production Lightnings, a feature of the general development programme for the aircraft has been the comprehensive systems and structural testing done at Warton. Indeed, in much of this, new ground was being broken—not so much for the fact that new "hardware" was involved, but because in the Lightning kinetic heating effects needed to be taken seriously into account and the aircraft's systems had, therefore, to be proved over a wide range of temperature.

As the aircraft had fully duplicated, irreversible power controls, a great deal of development work was needed on the power control units themselves as well as on the system as a whole. A power control rig was set up in which could be simulated all the controls and control runs; it was supplied with hot and cold air to reproduce the actual temperature experienced in flight. And in this rig endurance tests were accomplished with the object of achieving a system life of 6,750 hours—a practical life of 1,000 hr. with a factor of 6¾.

Similarly, a hydraulic system rig was built to prove the hydraulics at high and low temperature and to achieve a factored life for the system of 6,000 hours (1,000 hr. × 6). The fuel system and its integral wing tanks had also to be extensively rig-tested to establish the integrity of the system so far as functioning and fuel tightness were concerned and also to ensure that those capabilities would not be adversely affected during any manœuvre the airframe was likely to be called upon to execute.

An exhaustive structural test programme has covered major tests of the airframe, including tests to destruction. Two particular design cases that were covered in these tests represented a "fishtail" manœuvre which causes a yawing oscillation and is a critical case for the fin and rear fuselage; and a rolling pull-out case which is the critical one for outer wing.

Apart from its very thin (0.016 t/c) 60° swept untapered wing, perhaps the most characteristic feature of the Lightning is its deep parallel fuselage which houses the two powerplants, one above the other. This particular arrangement was chosen because, by having the lower engine ahead of the upper one, the overall frontal area of the fuselage could be kept to something less than that required by two engines in any other arrangement. Moreover, this disposition also meant that in the event of an engine failure, there are no resultant asymmetric yawing moments to contend with.

Another somewhat unusual feature of the layout has been the choice of a low-set tailplane. At the time when the Lightning made its first appearance it was the fashion in high-speed aircraft to have the tailplane on top of the fin—well out of the way of wing downwash and the jet efflux from the usual fuselage-side or wing-root mounted engines. There was no efflux problem with the Lightning, but English Electric's studies and wind-tunnel tests showed that by having the horizontal tail low down in relation to the fin, the pitch-up moments likely to be experienced with a supersonic airframe operating in subsonic or transonic régimes, would be avoided altogether. The horizontal tail surfaces are, it will be noted, heavily swept to match the mainplane geometry.

Structurally, the airframe of the Lightning is reasonably orthodox and of the "solid" variety one expects in a supersonic type. Perhaps the most interesting feature here is the five-spar torsion box of the mainplane. Each half-wing is built separately as a sub-assembly and is joined on the fuselage centre-line by means of a solid machine centre-line rib to form a complete spanwise unit.

The shallow depth of the wing together with its inevitable structural density posed some difficult production problems which in turn had a bearing on the type of structure finally selected. Apart from any problem associated with the fuel tightness of the wing as a fuel tank, the principal difficulty was, of course, brought about by the very limited access to the interior of the wing for assembly purposes.

The wings are skinned with 0.2-in. thick DTD 687 panels reinforced at their inboard end by additional thick laminations and reduced in thickness outboard by controlled-depth routing. The internal structure comprises the five spars already mentioned between each of which are two extruded spanwise stringers, riveted to the skin panels, and chordwise rib members similarly attached. The ribs and spars are built up with booms, diagonal bracing members and vertical struts—the last-named serving as combined attachment for the rib and spar diagonals.

For assembly of these wing units the skin panels are built up as complete sub-assemblies with all the spar booms, rib booms and stringers riveted into position with all the mating surfaces coated with sealant. The bottom skin is then held in a horizontal jig and the vertical spar and rib members attached to it. The top skin is then lowered into position and the internal attachments made, working progressively outward from the centre. Because the access to the interior is so limited, the front and rear spars are not assembled to the structure until all the internal assembly is completed; they are then finally attached by means of a special portable squeeze riveter.

Conventional leading- and trailing-edge portions complete the wing structure and these are assembled to the wing torsion box in a separate jig.

As yet no detailed performance figures for the Lightning have been published. It has however been disclosed that,

LIGHTNING LINE.—Part of the final assembly line of English Electric Lightnings at the company's Samlesbury factory. This line receives wings and front fuselages from Preston, and main fuselages and tail surfaces from Accrington.

powered by its two Avon RA.24Rs—which deliver a dry thrust of 11,250 lb. each (or 14,430 lb. with reheat)—the aircraft is capable of reaching a speed of Mach 0.9 in level flight at operational altitude within 2½ minutes of the time the brakes are released for take-off. The Lightning is capable of operating at altitudes above 60,000 ft. and it can accelerate from Mach 1 to Mach 2 in less than 3½ min.

The first news of a Lightning reaching a speed twice that of sound came in January, 1959; previously, in July, 1957, it had been revealed that one of the prototypes had exceeded 1,132 m.p.h. (Mach 1.73). And looking to future developments, it has been said by the present Chief of the Air Staff, Air Chief Marshal Sir Thomas Pike, that Lightnings will eventually be capable of attaining a speed of 1,500 m.p.h.

The English Electric Lightning has the distinction of being the R.A.F.'s first truly supersonic fighter; it is also claimed to be Fighter Command's first integrated weapons system platform. It is a type with considerable potential "stretch" and already the F.Mk.2 and F.Mk.3 variants are on the production line together with a two-seat operational trainer version. All of which points to a promising future for a remarkable aeroplane.

KEY TO DRAWINGS

1. Bullet—houses radar and mounted on wheel-well box 2 set on floor 8 of engine air intake 3.
3. Engine air intake (top surface section shown at 4 *down* to cockpit floor, *up* at 5 to roof of the overwing intake 6 to upper engine 7).
8. Floor of intake 3 runs straight through to lower engine 9.
10. Leading-edge of wing centre section divides airflow to engines (7 and 9).
11. Cut-away of top surface 5 to reveal bifurcation 10.
12. Jet pipe of upper engine.
13. Extended jet pipe of lower engine.
14. Reheat units.
15. Faired bullet spacer providing throughway for radar electrics 16 into bullet.
17. Oxygen cylinder.
18. End-frame of front fuselage (picks up to wing front fitting 19 of rear fuselage).
20. Rear fuselage with longeron 20, strongly ribbed between-deck 21 and lower hoops 22, engine-bay stressed top cover 23, back-end continuous frame 24, stressed arch 25 over wing centre section with longeron plate and angle 26, underwing side-panel 27 with similar plate longeron and angle to wing, and underskin attachments 28.
29. Wing rear-spar fitting 30 picks up off strengthened frame 29 (see detail).
31. Engine main (trunnion) supports (see near 29 and longeron 20 near airbrakes).
32. Airbrake and double-acting hydraulic jack (electro-hydraulic selection from cockpit).
33. Reheat and jet-pipe intermediate supports (self-aligning trunnion block off frame into channel on pipe). (Repeat on lower pipe.)
34. Reheat and jet pipes end support (trunnion on pipe held in clamp on frame).
35. Rollers 35 swing down on to fixed rail 36 to run jet pipe out.
37. Root of fin. Top jet pipe guide-rail and ground-handling link roller (because rail 36 has to be cut away in places).
38. H-piece between jet pipes, hinged each side at 39 and made in two pieces joined at 40. (Seals the back end but can be swung open for pipe removal.) (See detail on back of pull-out.)
41. Five-spar fin attachment to fuselage (one single, four double tongues) with stringers and ribs, all between front and rear shear walls 42.
43. Honeycomb rudder has bracket splined to operating mechanism.
44. Flutter damper.
45. Honeycomb fin tip.
46. Pivoting tailplane (torsion box with pivot spar 46), front and rear shear webs, formers, stringers and stressed skin, and honeycomb tip 47.
48. Bearing housing, built into fuselage frame, carries spindle of 46.
49. Triangular arm off spindle (rocked by jacks 50 to move tailplane through 51).
52. Parachute pack in fuselage container, with power-operated doors 53, which slide up to uncover container.
54. Parachute lines run out through skid 54 and loop around both sides of fuselage at 55 up to (quick-release) anchorage 56.

MAINPLANE

57. Port and starboard torsion boxes between curved front and rear spars 57, picking up to fuselage on fittings 19 and 30, and with three intermediate spars and bracing 58, ribs, stringers and stressed skin. Wings join on centreline H-beam 59. (See detail on back of pull-out.)
60. Undercarriage support beam with main hinge point at 61.
63. Undercarriage retraction jack picking up on main leg at 62.
64. Operating jack inside top radius rod projects a stub to engage the tang 65, which is solid part of lower rod and thus locks rods against folding. (See detail on back of pull-out.)
66. Wheel well and door 67.
68. Aileron with honeycomb tip 69.
70. Hinged flaps with double-acting hydraulic jacks 71 (electro-hydraulic selection from cockpit).
70A. Ventral fuel tank.

FLYING CONTROLS. (All are power operated from the hydraulic system)

Aileron (and see layout on back of pull-out)

72. From stick via artificial-feel torsion unit 72A and trim actuator 72B controlled by switch on stick, console (72), with pressure gland similar to 73 through cockpit rear pressure bulkhead, along to non-linear gear at 74, out by curved rods (75) and linkage (76) to operate follow-up jacks (77).
78. Aileron autostabilizer actuator overriding into linkage (77).

Tailplane

79. From stick thence via console and glands (similar to 72 and 73), bellcrank (79) underwing (80) to feel unit (81) and trim actuator (82), rod (83) to operate hydraulic motor unit (84).
84. Hydraulic motors drive screw jacks 50 to move tailplane.
85. Autostabilizer actuator overrides into rod (83).

Rudder

86. From rudder bar with weighted LH pedal 86 (to counteract speed-change inertia), thence via console and gland (73), bellcrank 79A alongside 79, underwing alongside 80, rod (87) (see starboard side at end of upper engine to linear spring-feel lever 87A (not shown) to give artificial feel, thence to rudder-feel 88 unit and trim actuator (88A) plus autostabilizer (89).
88. Rudder-feel unit (hydraulic, from feel simulator) with out-of-trim actuator from switches on the stick, then on via rods (90) to follow-up jack (91) to rudder stub (43).
89. Autostabilizer actuator overrides into rod (90).

NOTE: 88, 89, 90 and 91 are actually on starboard side (extension of rod (87) and spring-feel unit), but drawn on port side to show them.

POWER INSTALLATIONS

92. Rolls-Royce Avon lower engine (intake at 9) (main trunnion mounting at 31).
93. Upper engine (intake at 7) (mounted at 31).
94. Port and starboard 15th-stage compressor tappings for air systems and auxiliaries' drive (as well as engine intake anti-icing 95) plus two 15th-stage tappings for reheat, fuel and hydraulic systems (repeat on lower engine).
96. Two hydraulic pumps on external wheelcase for hydraulic systems.
96A. Reservoirs pressurized via pipe 96B.
96C. To aileron control units, undercarriages, port tailplane motor, rudder control unit, braking-parachute door selector.
97. Engine air (15th stage) tapping to drive reheat fuel pump. (Repeat on lower engine.)
98. Compressor relief valve (out through fuselage). (Repeat on lower engine.)
99. Engine starting equipment comprising: fuel tank (99), pump units (100), H.P. switch and solenoid valve (101), fuel and purging air lines (102) down to engines' intake casings.

AIR SYSTEMS (and see layout on back of pull-out)

(a) to Rear Fuselage

103. Hot air off lower engine 15th stage (94) joins with trunk (104) from upper engine to feed (aft) to auxiliaries' gearbox drive-turbine (105) (exhausting at 106), with branch 104A to reheat nozzle control rams. Ram air 106B from fin cools auxiliaries then overboard via heat exchanger (106A) in hydraulics supply from engine-driven pumps.
107. Tapping to reheat units muffs (to induce on ground cold air cooling flow through muff).

(b) Demisting, Gun-purging and Anti-icing Systems

108. Hot-air trunk from engines goes *forward* with a branch (109). Trunk (108), with a branch to canopy seal 114 and ground supply connection, then runs to gun-purging valve (110) (operates to blow inflammable gases out of breech after firing via branch up to guns 135). Trunk (108) on to air intake anti-icing (111) with branch-offs for windscreen rain-dispersal (112), side panel and canopy hot-air sprays (113), canopy seal (114).
115. Canopy side-panel closed-circuit dried air from electric blower (115) through silica-gel dryers (116) and pipe (117) to panels, collected at 118 and back to pump. Pressure build-up vented from lower engine to atmosphere.
116A. Eighth-stage air from lower engine to guided-weapon pack heating.

(c) Cockpit Air System

109. Hot-air branch off 108 to heat exchanger (117) (see below) with a branch-off, via reducing valve, direct to 121.
117. Heat exchanger alongside with header tank to boiler (118) set in the junction of engine airstreams (and with cooling-air entry to it from them at 10).
118. Cooled air on to water boiler (118) gives up heat and on to two-spool pump (*its* spool working against other driven by air bleed (120) from trunk, which bleed then passes back into trunk at 126A. Air thus further cooled and on to water separator (121), with branch-off up to radio cooling (122) with ram-air connection (123).
121. From water separator on via 124 (with ground connection to heat exchanger 125). Thence into cockpit for three-outlet pressurizing at 127. Pipe 126 divides upstream of heat exchanger (125). One branch goes through (125) to anti-g and air-ventilated-suit connections 128A; the second branch goes direct to bullet (pressurized radar) via air dryer (128). The cockpit air is directed through heat exchanger 125 as the cooling medium and then to cockpit.
129. Combined valve unit in conjunction with pressure controller in cockpit (cockpit relief). Built-in shroud passes some cockpit air out down to bullet heat exchanger through 129A plus branch for ground cooling attachment 129B.
129C. Pressurized cockpit (floor, canopy, bulkheads) with relief valve.

HYDRAULIC SYSTEMS

Pressure oil from engine pumps (96) and reservoirs 96A plus ground hand pump to:—
(a) Undercarriage flaps, autostabilizer actuators, feel units, canopy jack, missile pack.
(b) Aileron, tailplane, rudder.

96B. Air to reservoir from a 15th-stage engine tapping runs via exchanger (106A).

REHEAT FUEL PUMPS (one to each unit)

130. Fuel pump to each reheat unit (14) via piping 131 and 132. Air driven via 97 (15th-stage engine and overboard).

FIRE PROTECTION

Fire Zone I (each engine): A to B (intake to firewall).
Fire Zone II (each engine): B to C (firewall to exhaust section).
Fire Zone III (common to the two engine jet pipes): C, C to D.

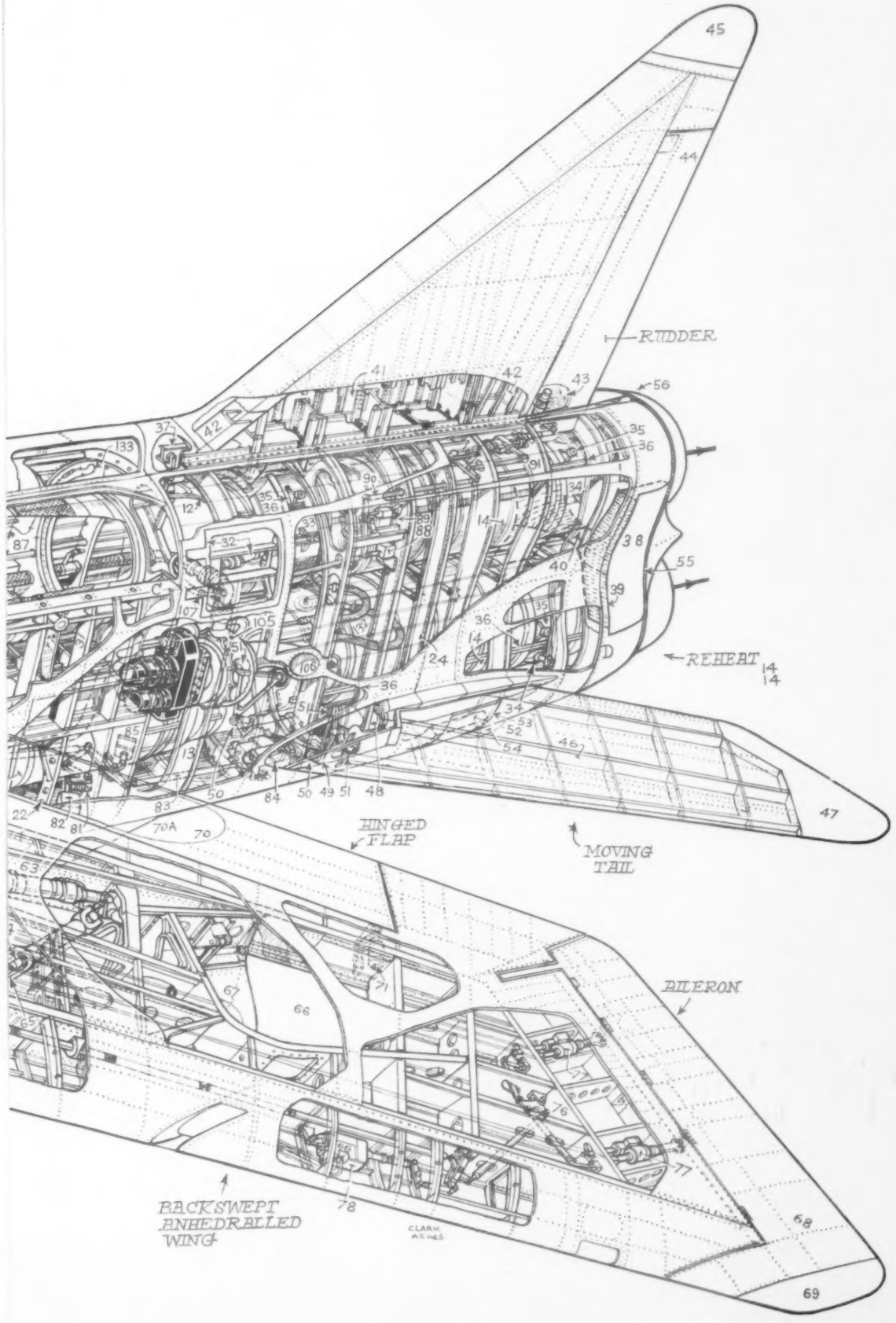
132X. Port extinguisher serves both Zones II (starboard extension serves both Zones I).
133. Typical Firewire sensing element (one element each engine (Zones I, plus II), plus one to each jet pipe in Zone II, equals four elements).
134. Inertia switch each side to set off both extinguishers at 4½ *g*.

Fire Zone Ventilation

Zones I and II each engine: fore and aft intakes and outlets with engine hot-air induced flow out Zone II ventilates by tapping off air from auxiliaries (remainder going on through 106A).

ARMAMENT

135. Line of (two) Aden cannon and two magazines.
136. Attachable underbelly pack, mounting cannon or rockets or twin missiles.


RUDDER
REHEAT
HINGED FLAP
MOVING TAIL
AILERON
BACKSWEPT ANHEDRALLED WING
CLARK ARMES

ENGLISH ELECTRIC LIGHT

Two 14,430 lb.s.t. Rolls-Royce Avon

Drawing by J. H. Clark, A.R.Ae.S.

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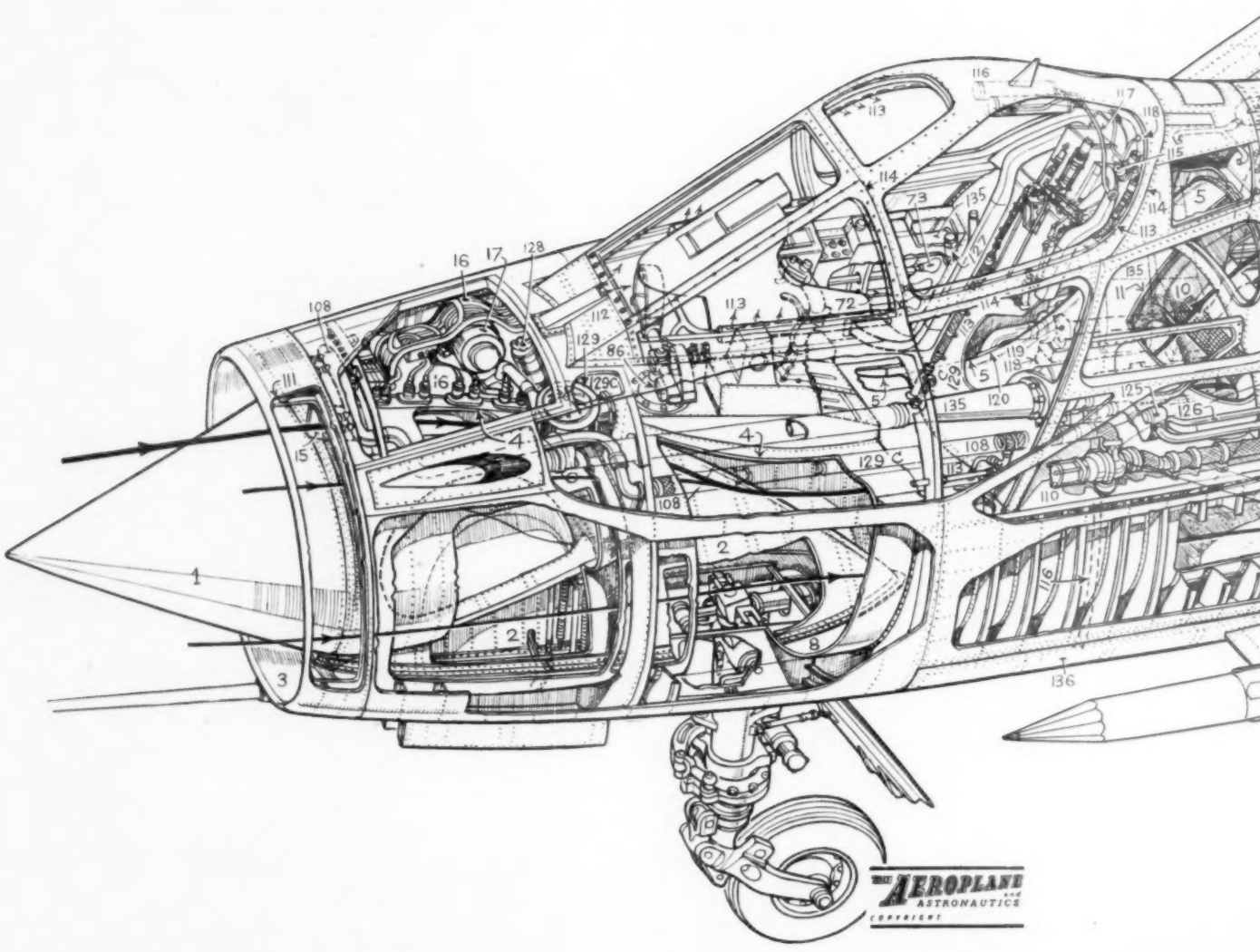
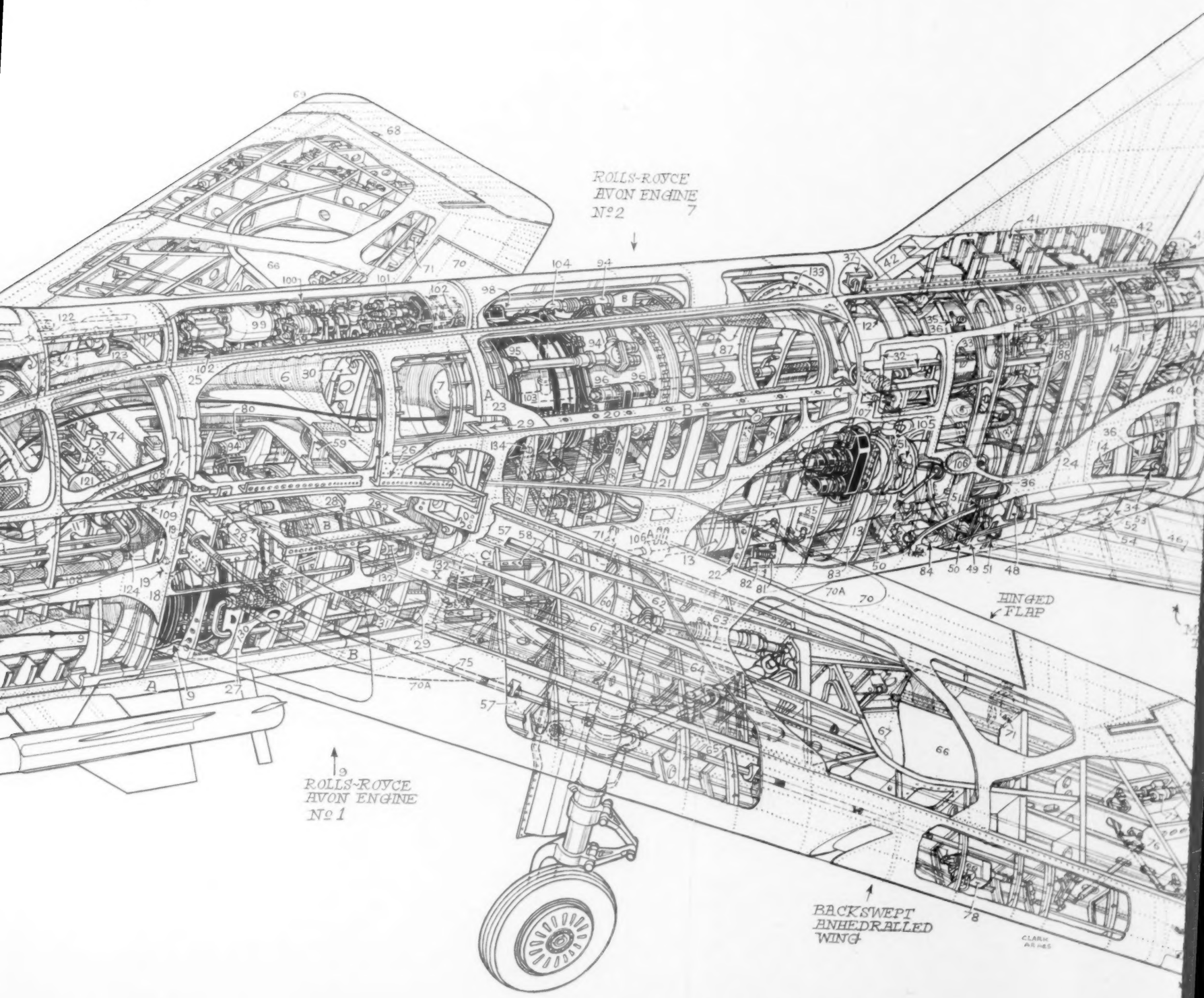


For Key see facing page

HTNING F.1

on Turbojets



LISH ELECTRIC LIGHTNING F.1

Two 14,430 lb.s.t. Rolls-Royce Avon Turbojets

wing by J. H. Clark, A.R.Ae.S.

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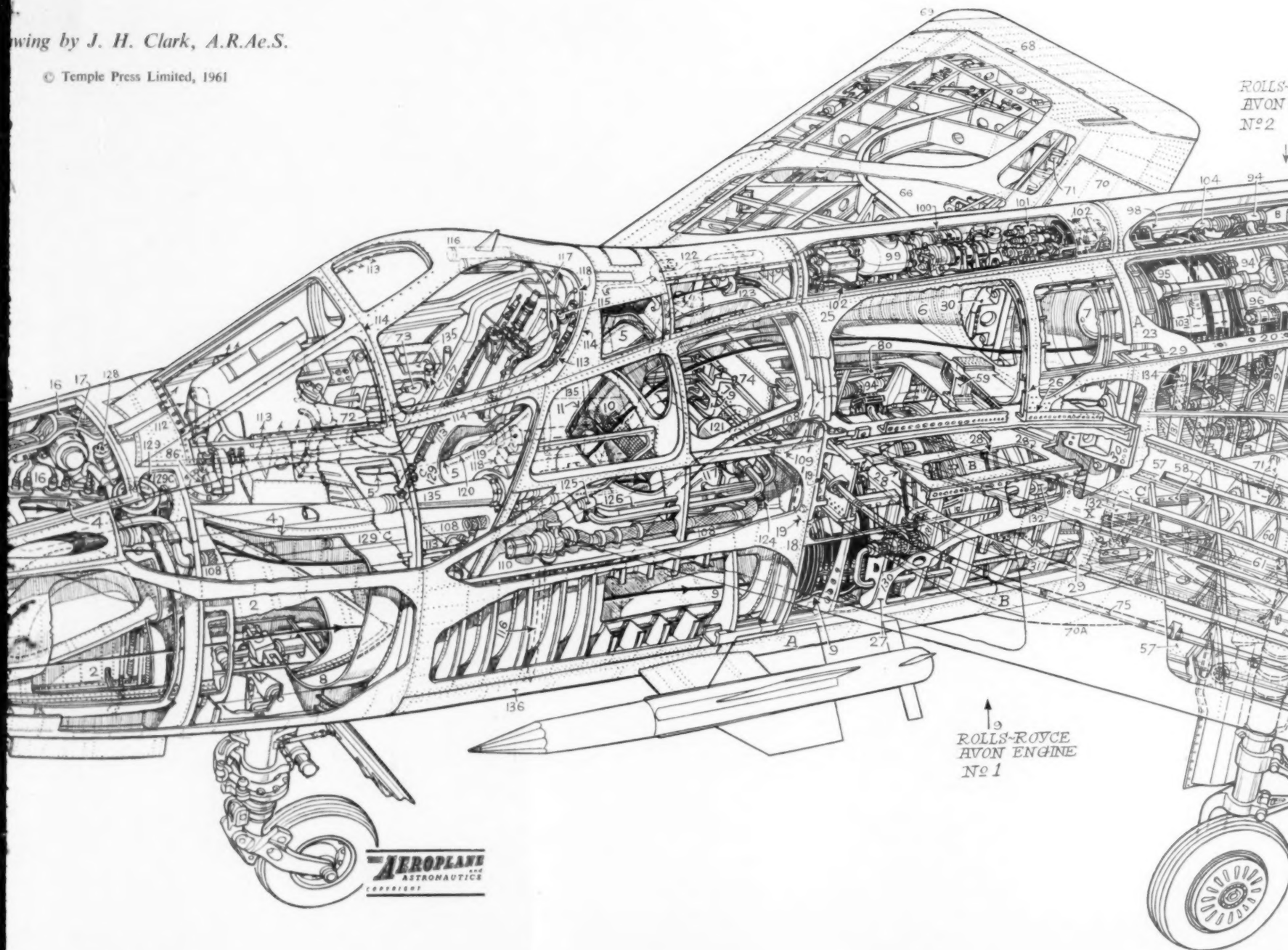

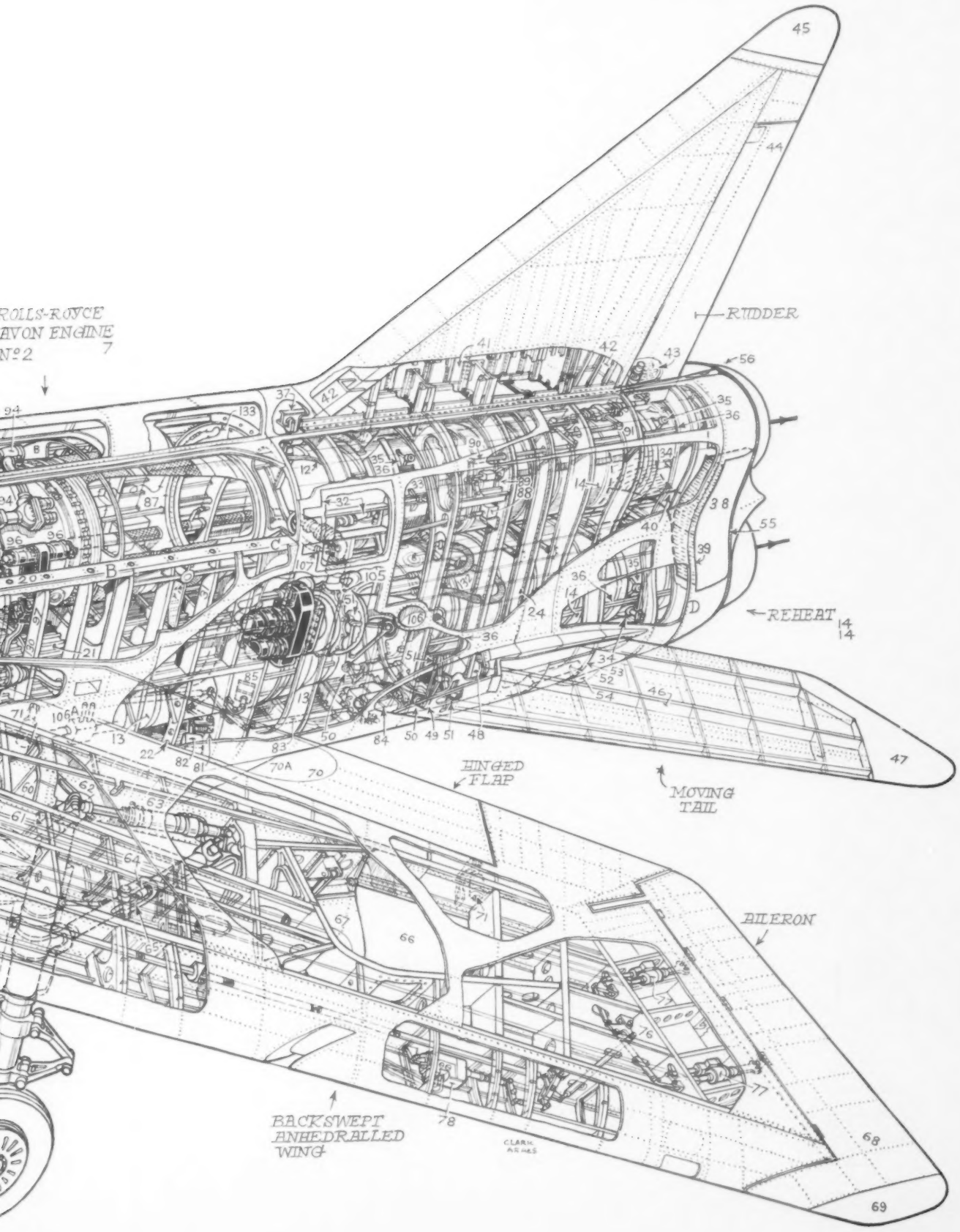
ROLLS-ROYCE
AVON ENGINE
N°2
RUDDER
REHEAT
HINGED
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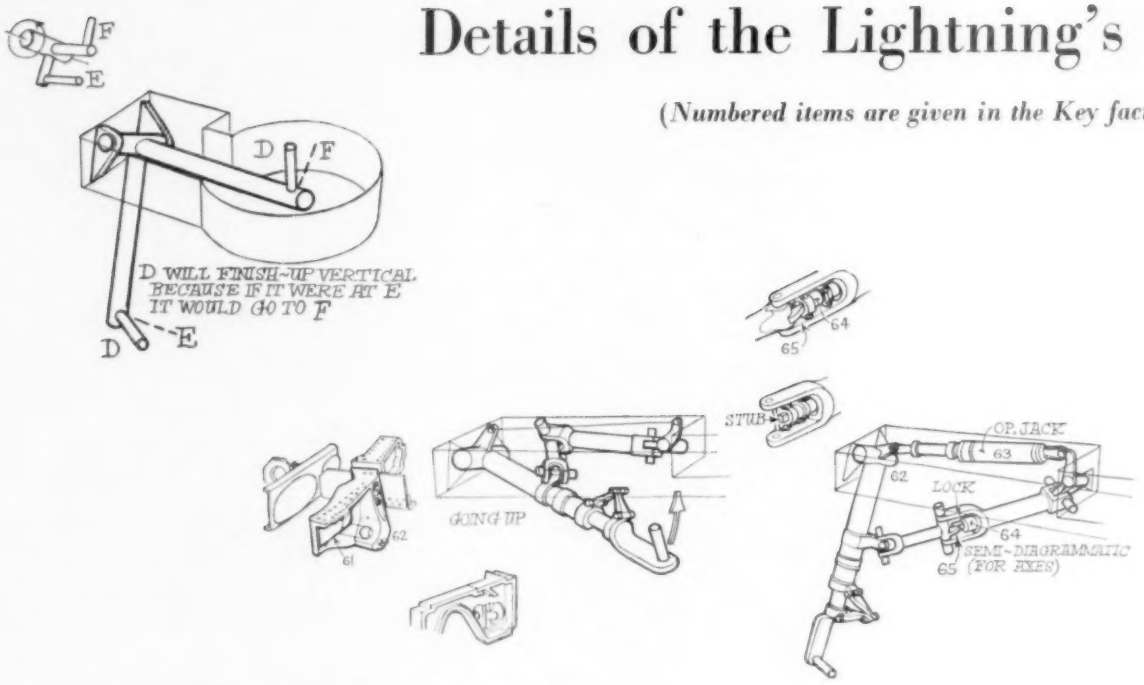
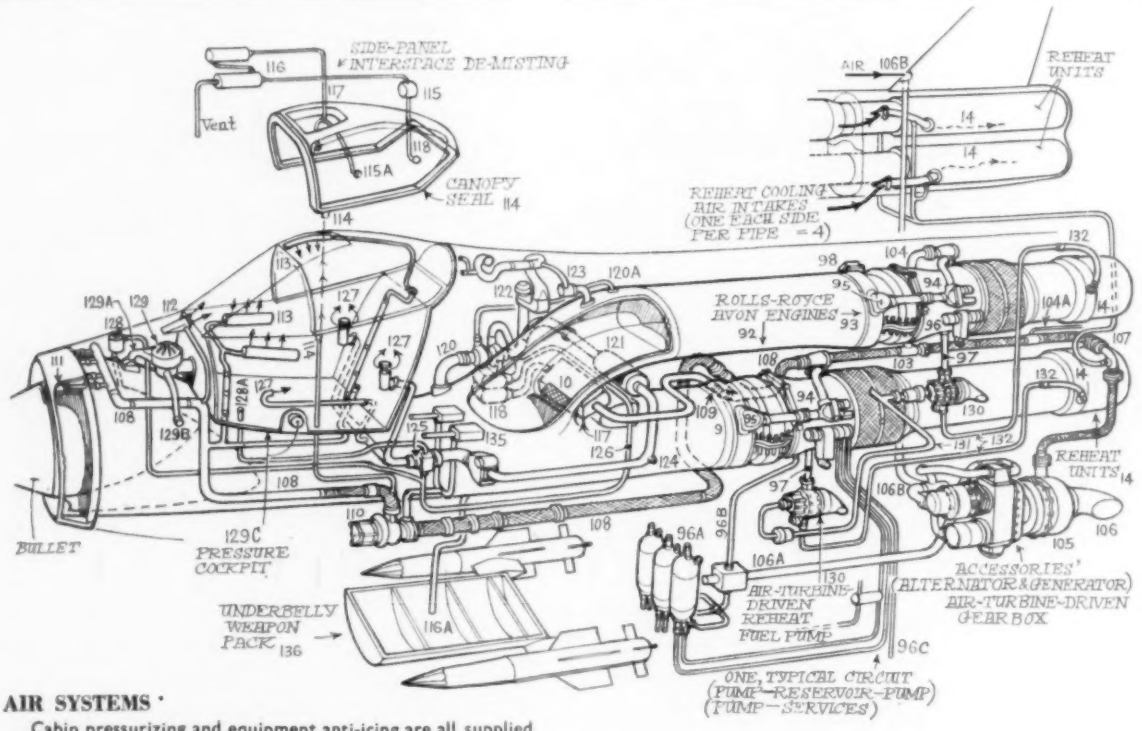
WING
CLARK
ARMES

Details of the Lightning's St

(Numbered items are given in the Key facing th



UNDERCARRIAGE MOTION (GEOMETRY) AND LOCKS



AIR SYSTEMS

Cabin pressurizing and equipment anti-icing are all supplied from engine compressor tappings suitably refrigerated. The layout is shown here separated from the structure.

Structure and Systems

cing the main drawing over page.)

Drawings by J. H. Clark, A.R.Ae.S.

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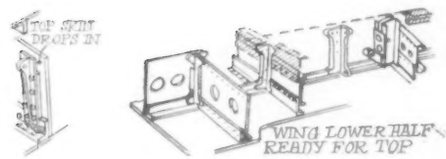
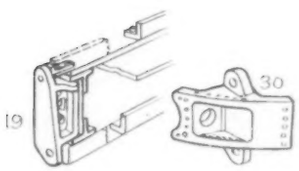
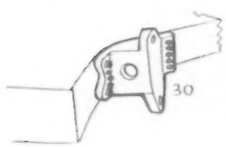
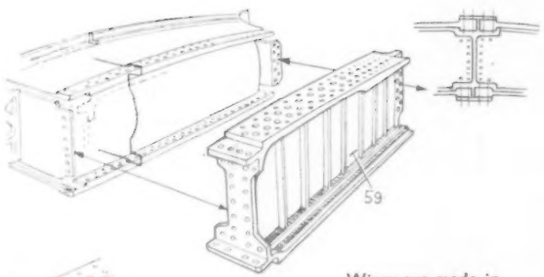


See end of Key for description.





WING ATTACHMENT DETAILS



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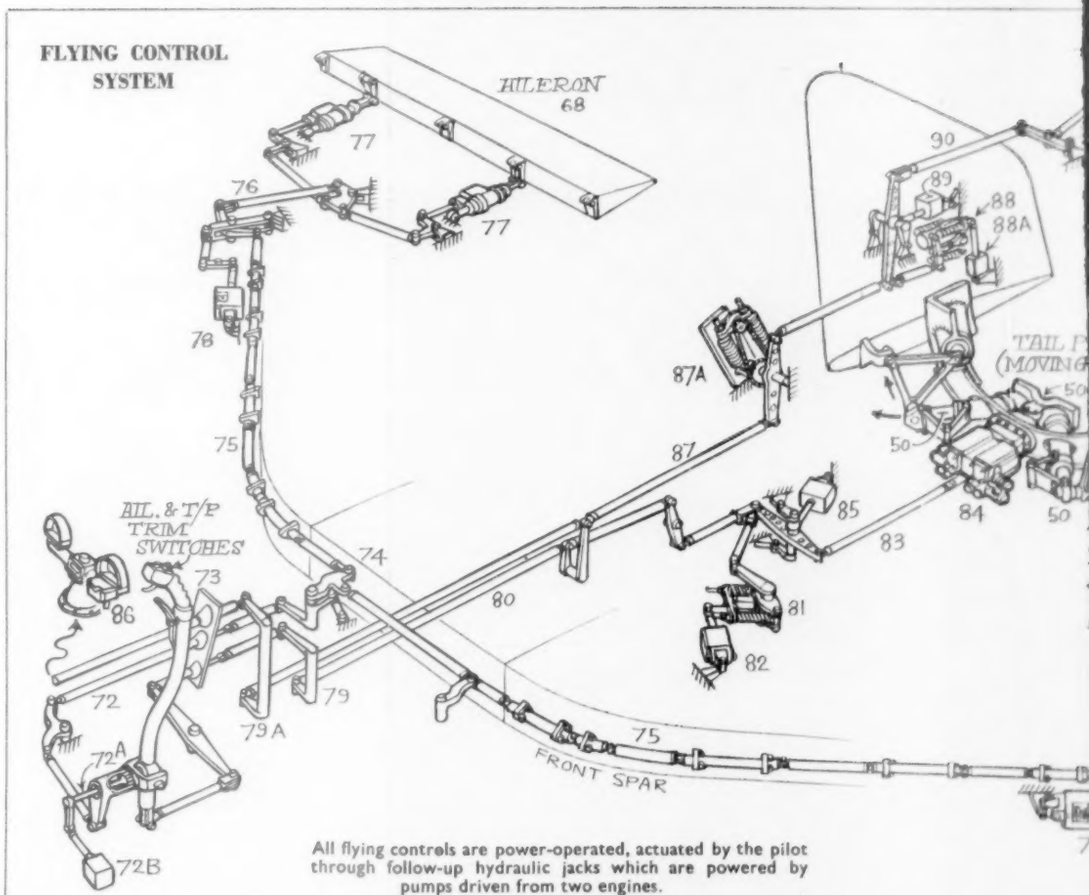
FLYING CONTROL SYSTEM



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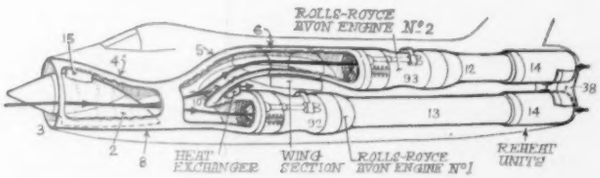

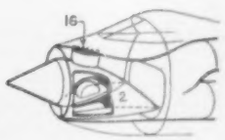

ENGINE AIR DUCTING IN THE AIRCRAFT

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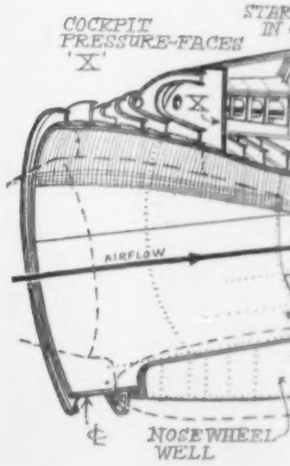

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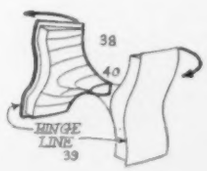

Details of the Lightning's Structure and Systems

(Numbered items are given in the Key facing the main drawing over page.)

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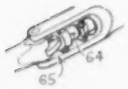
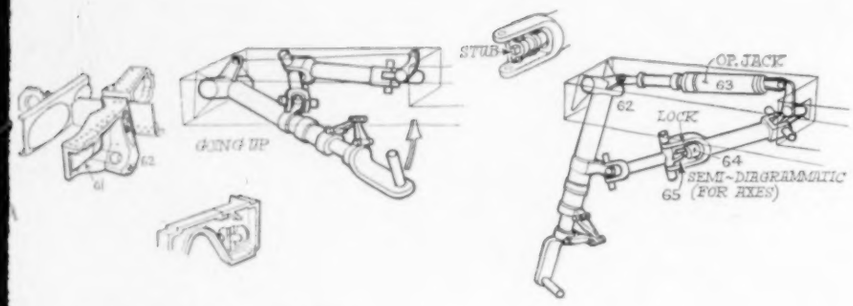
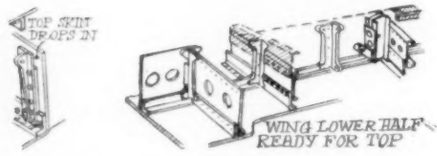




OTION (GEOMETRY) AND LOCKS

Drawings by J. H. Clark, A.R.Ae.S.

© Temple Press Limited, 1961



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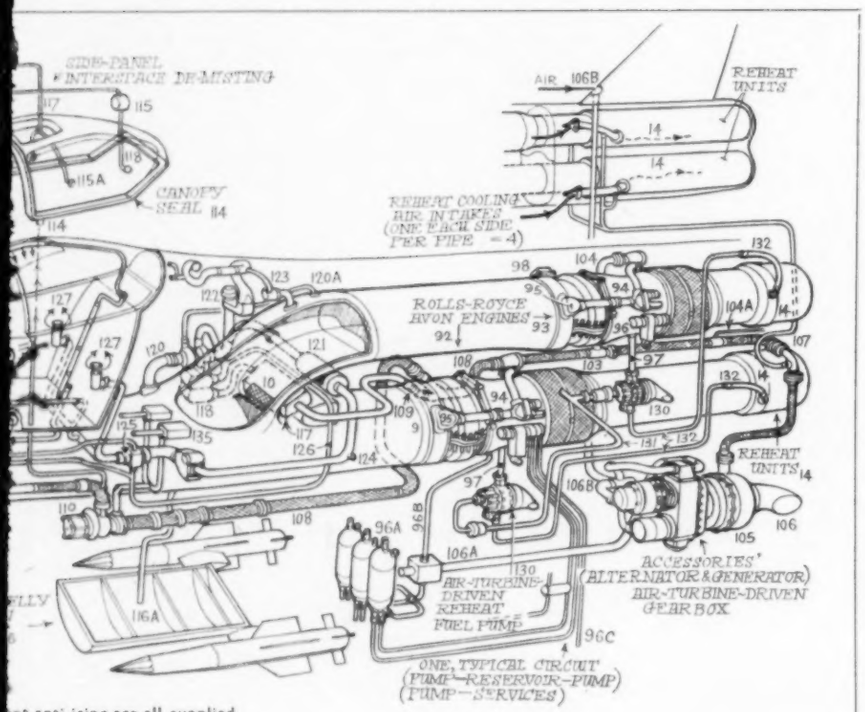

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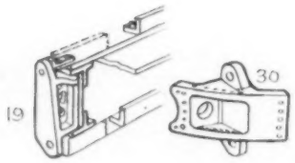

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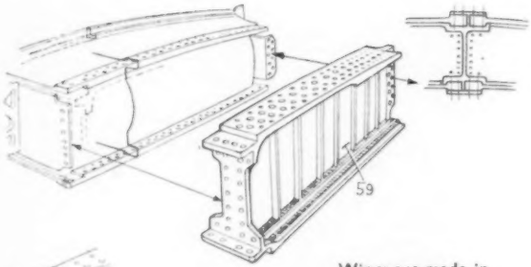

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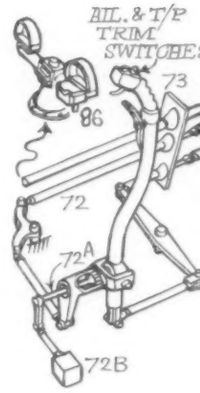

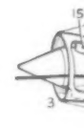

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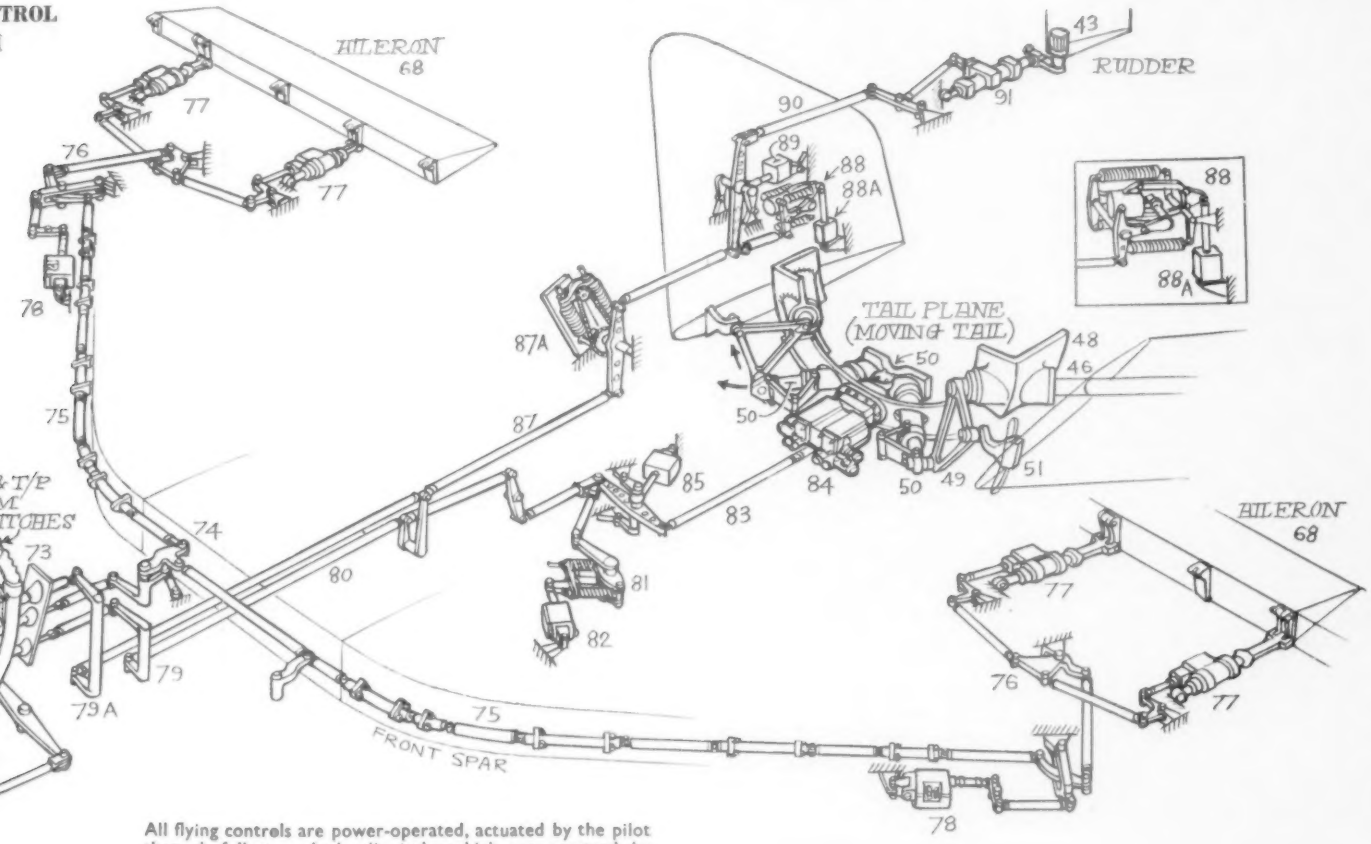

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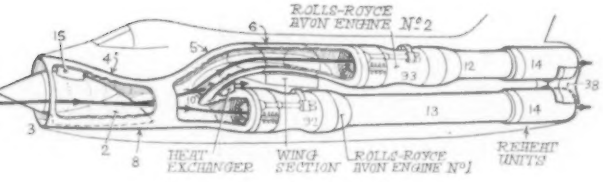

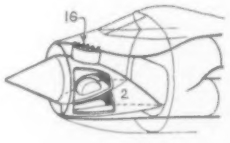

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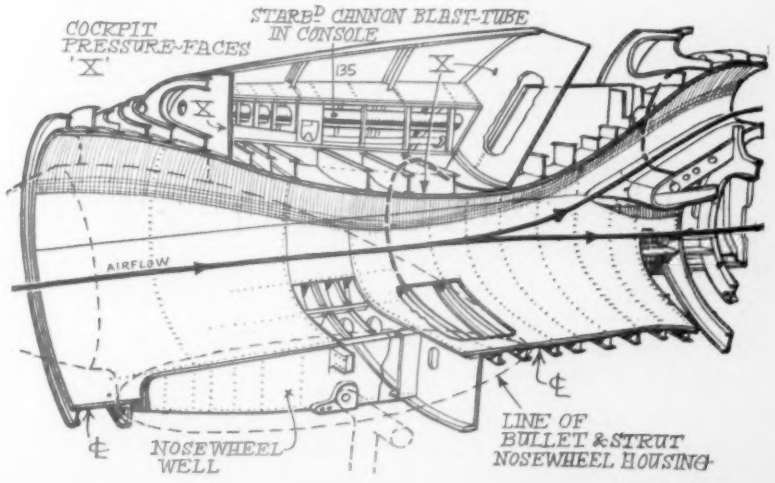

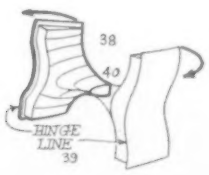

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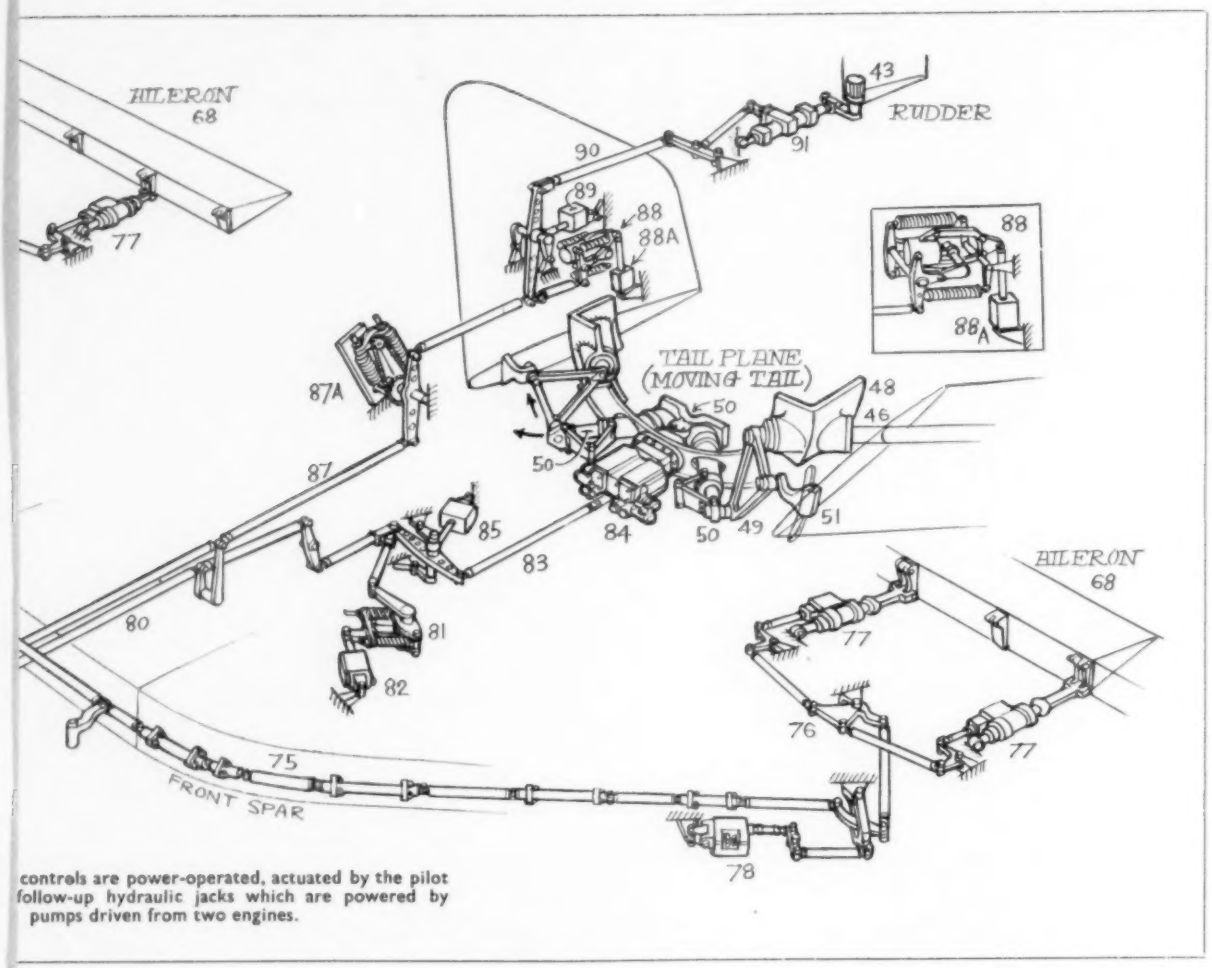

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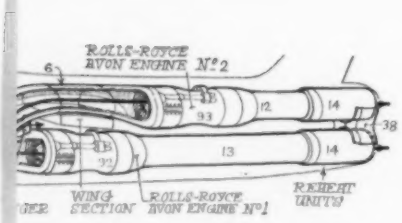

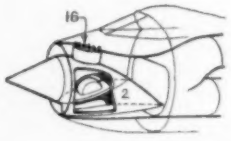

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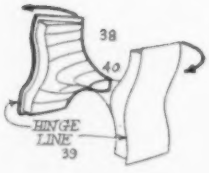
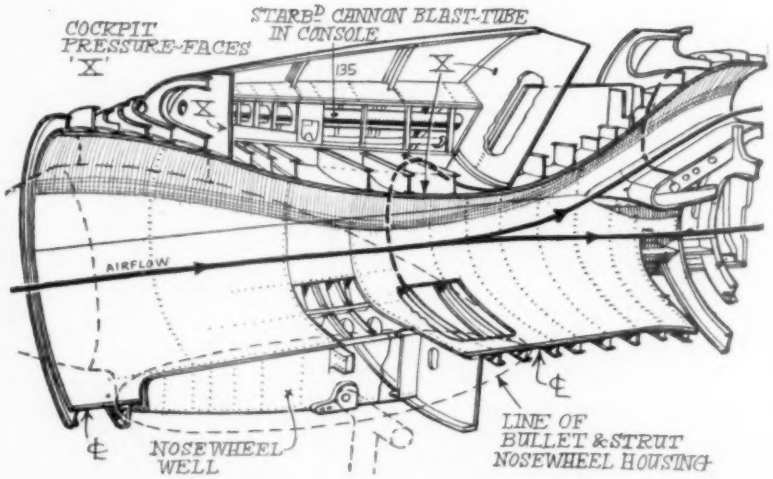




Commercial Aviation Affairs

APRIL ACTIVITY.—Air transport movements at U.K. aerodromes in April, 1961, totalled 32,524—5% more than the previous year. The number of passengers increased by 13% and freight by 7%.

FALCON APPEALS.—An appeal has been lodged by Falcon Airways, Ltd., against the decision of the Director of Aviation Safety to limit the company's air operator's certificate to region C (Europe and the Black Sea area). Mr. J. Roland Adams, Q.C., with Capt. J. C. Harrington as technical assessor, was to hear the appeal in public on Jly. 12 at 10.30 hrs., at No. 10 Carlton House Terrace, S.W.1.

SABENA CARAVELLES.—Two more Caravelle VIs have been purchased by Sabena for delivery in July and August. Six are already in service.

S.A.S. CHARTER INTEREST.—Formation of a new charter airline, Scanair, has been announced in Copenhagen. S.A.S. has a 45% interest, the remainder of the shares being owned by Saab, the Danish East Asian Company and the Norwegian Mariana shipping concern. Four DC-7Cs are to be leased from S.A.S.

AMERICAN MERGER?—C.A.B. has been told by Pan American that it is willing to negotiate a merger with, or the acquisition of, North-East Airlines. C.A.B. has been seeking an alternative to the proposed Northwest-T.W.A. merger because of the latter airline's difficulty in completing the deal.

LOW-FARE ROUTE.—Application has been made by Riddle Airlines to the C.A.B. for a passenger route between Boston, New York and Miami also serving intermediate cities. The service would be operated as a low-fare, no frills, air-bus type operation and would supplement the company's north-south cargo operation.

RIDDLE BUSINESS.—Military contracts worth $15.4 million have been awarded to Riddle Airlines for the year starting Jly. 1. They include a $7.5 million contract for Logair flights with the A.W. Argosy and three other contracts for MATS international charters by DC-7CFs, Logair flights by C-46 and an Alaskan fuel contract.

S.A.S.-FINNAIR AGREEMENT.—A five-year traffic agreement between S.A.S. and Finnair will come into effect on Nov. 1 and will cover technical collaboration as well as pooling of traffic.

NAIROBI EXTENSION.—The 10,000-ft. runway at Nairobi Airport is to be extended by nearly 3,000 ft. to permit unlimited operation by large jet aircraft flying long stages from the airport.

AGE RULE CONFIRMED.—Mr. N. E. Halaby, the new F.A.A. Administrator, has confirmed the Agency rule enforcing a pilots' retirement age of 60. The recent ICAO decision in favour of this age limit has strengthened the F.A.A.'s opinion.

PAN AM CARGO PAKS.—Air-Pak palletized pre-loading is to be adopted by Pan American in its DC-7F Cargo Clippers. Each aircraft will carry seven pallets, measuring 88 by 108 in. and able to carry 6,700 lb. of freight each. Their use will permit 80% of the DC-7s cubic payload capacity to be utilized.

COACH ELECTRAS.—American Airlines is to introduce coach class service on its Lockheed Electras for the first time this month. The accommodation is to be changed from 68 first class to 54 first class and 17 coach class seats, and services in this configuration will begin on Jly. 17.

PRESTWICK HOTEL.—The Ministry of Aviation is shortly to invite tenders for a new luxury hotel at Prestwick Airport, which is intended to cater for tourists as well as passengers using the airport.

DME FOR T.W.A.—New DME equipment produced by Collins Radio is to be fitted to all T.W.A. jetliners in service by Oct. 1, as well as on the 26 Boeing 707/720s for delivery next year.

LAST NORTH STAR. — T.C.A. operated its last North Star on Jly. 1, on the night freight service from Vancouver to Montreal.

AIR FARES UP.—Increasing costs have led to increased fares on Indian Air Lines routes with effect from next October. Fares on Viscount services will increase by 10% and those on DC-3 services by 5%.

B.U.A. EXPANSION.—The helicopter unit of Christian Salvesen and Co., Ltd., comprising three Westland Whirlwinds with associated spares, has been purchased by British United Airways and will in future be based at Redhill.

IATA MEMBERS.—Three new members of IATA bring the total number of airlines represented to 92. The newcomers are Air Guinée, Air Mali and Trans Atlantica Argentina.

News About People

REFUELLING PROMOTION.—Mr. Michael Cobham has been appointed deputy managing director and chief executive of Flight Refuelling, Ltd., under his father, Sir Alan Cobham, who is the company's chairman and managing director.

B.S. APPOINTMENTS. — Bristol Siddeley Engines, Ltd., announce that Mr. R. L. Ninnes, special director responsible for the company's technical services, is to direct the activities of its European headquarters to be established in Paris in September. Mr. B. D. Blackwell, deputy chief engineer, aero research and development, is to succeed Brig. J. Innes, a special director, as business manager (aero). Mr. Blackwell's appointment becomes effective on Sept. 1 and Brig. Innes is to retire from the company at the end of July, 1962.

CANADIAN STRIKER.—Just airborne from Lockheed's Palmdale airfield where it is being flight tested is the first production Canadair CF-104. Eight squadrons of the R.C.A.F.'s European Air Division are to be re-equipped with this type.

SPACE LECTURE. — Dr. Bobrov, chief scientist of the Astronautics Society of the Soviet Academy of Sciences, is to lecture to the R.Ae.S. tomorrow, Jly. 14, on "Spacemen and Space Neighbours of the Earth." This will be given in the lecture theatre, 4 Hamilton Place, London, W.1, at 18.00 hrs.

CASTROL APPOINTMENT.—Mr. J. A. V. Watson who, as previously recorded, becomes an assistant managing director of Castrol, Ltd., on Jan. 1, 1962, also becomes assistant managing director of Castrol Industrial, Ltd., on that date. He succeeds Mr. W. F. List who is retiring.

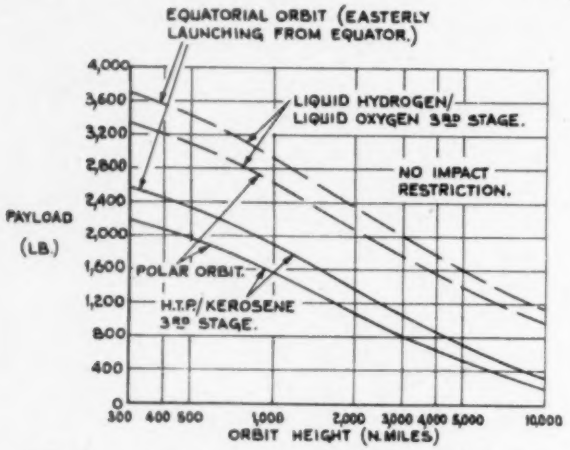
MEN AT WORK.—During April the number of people employed in the manufacture and repair of aircraft was 297,700, an increase of 1,200 over the March figure and 12,800 more than in April, 1960.

INDUSTRIAL SALES.—Mr. M. J. Parsons has succeeded Mr. A. A. Morris as industrial sales manager of Northey Rotary Compressors, Ltd., of Parkstone, Dorset.

European Space Booster

WITH the news last week that the Federal German Government has decided to join Britain and France in developing a heavy satellite launcher, based on the de Havilland Blue Streak, the prospects for European collaboration in an exciting new field of technology have at last been assured. The initial programme envisages the use of a three-stage booster as being suitable for launching both research and communication satellites.

Quite different requirements are necessary for each purpose and the launcher would be capable of delivering satellites of different weights and uses into a variety of orbits ranging from low-altitude orbits of a hundred miles or so (with satellite payloads up to 2,000 lb.) to orbits reaching out to 100,000 miles in the case of small scientific satellites weighing about 100 lb. These widely differing requirements can be achieved



Effect of introducing liquid-oxygen/liquid-hydrogen third stage on payloads projected into circular orbits.

through the launching system proposed, only the third propulsion stage needing to be varied to meet the differing aims.

The problems of designing this multi-purpose booster were discussed in detail by Mr. D. J. Lyons of the Guided Weapons Department, R.A.E., on Jly. 6 during the Radio Techniques and Space Research Convention organized by the British Institution of Radio Engineers in Oxford.

The present proposals, he said, were firmly based on the use of Blue Streak as the first stage and a French rocket, as yet unnamed, as the second stage. No firm European proposals had been made regarding the design and construction of a third end-stage for final injection into orbit, but in order to demonstrate the capabilities, two propellent combinations had been considered in assessment of possible third stages.

The first, hydrogen peroxide/kerosene, a conventional, relatively low-energy propellent combination, was considered for its comparative ease of development. The second, liquid hydrogen/liquid oxygen, yielding a greatly improved performance in terms of payload, especially in distant orbits, demanded more extensive development. (See THE AEROPLANE AND ASTRONAUTICS, May 18, 1961, pp. 561-2.)

The first stage, Blue Streak, stripped of the equipment associated with its military guidance and warhead, required minor modifications of the separation bay to carry the second stage. It was propelled by two pump-fed liquid oxygen/kerosene engines, each rated at 137,000 lb. thrust at sea level, and in course of being uprated to 150,000 lb. thrust. (A full description of the Blue Streak propulsion system was given in our exclusive report last week.)

Stages Two and Three

The proposed French second stage rocket was propelled by an engine employing nitrogen tetroxide (N_2O_4) and unsymmetrical dimethyl hydrazine (U.D.M.H.) with a sea-level thrust of 25 tons. The propellents were pressure-fed to the single combustion chamber by means of a solid charge gas generator. The thrust chamber was gimbal-mounted for control in pitch and yaw, roll control being achieved by auxiliary jets.

In addition to the propulsion system, control system actuators and electronics, the second stage contained equipment for the initiation of engine light up on separation from the first stage, equipment for initiation of second/third stage separation, and rate gyros for autopilot stabilization during the period of second stage operation.

A third stage using the "continuous thrust" principles would need an engine working at a relatively low thrust level of between 1,000 and 3,000 lb. (for the low-perigee orbits), which would be started during separation from the second stage. The unit at present conceived was a four-chamber design, each chamber being pivoted about one axis for steering in pitch, yaw and roll as in Black Knight. With low thrust and four chambers, very high nozzle expansion ratios (of 1,000/1) were possible without undue chamber size, length and weight.

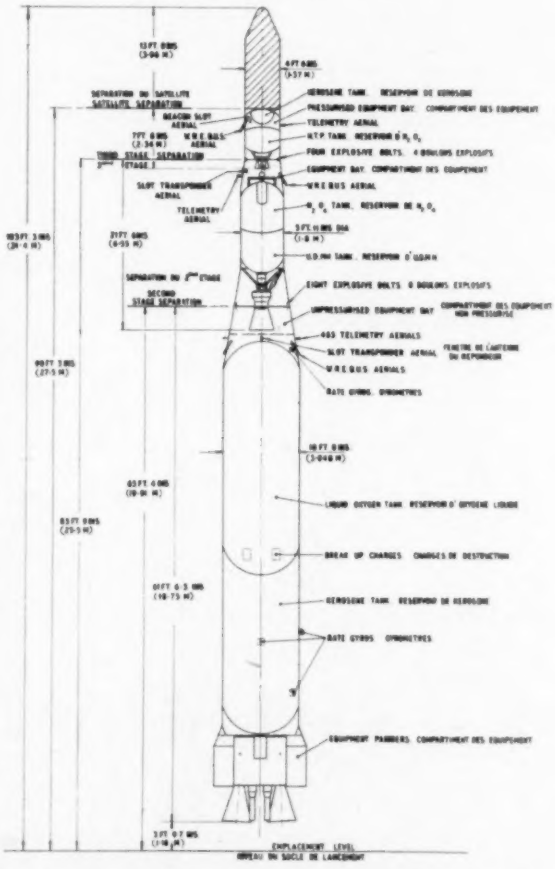
To minimize overall stage weight—by reducing the weight of the tanks—pump feeding of propellents was to be preferred in this particular design. The propellent pumps would be driven by a hydrogen peroxide steam turbine.

It was possible to meet the varying orbital requirements, Mr. Lyons went on, by exchanging payload weight for propellent weight in the third stage while maintaining constant the overall weight of the third stage plus satellite payload of some 5,000 lb. The tank volume, only, was altered to suit the orbital mission, allowing the remainder of the third stage, including the engine and all equipment, to remain sensibly unchanged.

Guidance

The complete launcher will be radar guided from the ground. The advantages of the radar system, Mr. Lyons said, were that

(*Continued on page 53*)



Proposed European satellite launcher based on Blue Streak with an unnamed French rocket as the second stage; design of the third stage is provisional. The weight breakdown is :— Nominal total at launching, 230,769 lb.; 1st. stage total, 207,579 lb., propellents, 193,892 lb., all-burnt, 13,687 lb.; 2nd stage total, 18,150 lb., propellents, 15,432 lb., all-burnt 2,718 lb.; 3rd stage total, 5,040 lb. (space probe mission), propellents 4,300 lb., all-burnt 700 lb;, including payload (nominal) 200 lb.; satellite fairings (jettisonable) 40 lb.

Photo: "Flight" *Aero Show 1911*

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BRITISH UNITED

THE SHORT HAUL JET

BAC ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

JET SUCCESSOR TO THE VISCOUNT

WITH EVEN BETTER THAN VISCOUNT ECONOMICS

AIRWAYS CHOOSES

- 540 m.p.h. cruise speed
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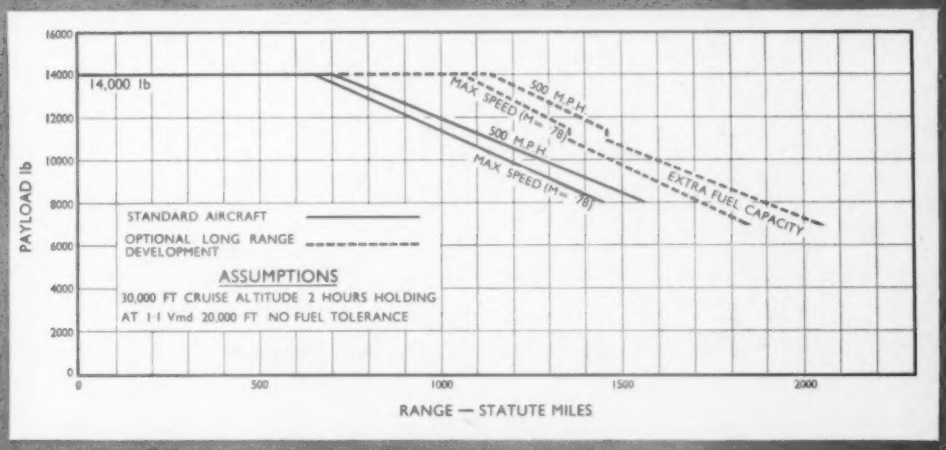
- Short airfield performance
- Quick turn-round: built-in auxiliary power unit
- Cabin width for spacious five-abreast seating
- Range of over 1,100 miles with full 14,000 lb payload

BRITISH UNITED AIRWAYS HAS CHOSEN THE OPTIONAL LONG RANGE DEVELOPMENT OF THE STANDARD AIRCRAFT

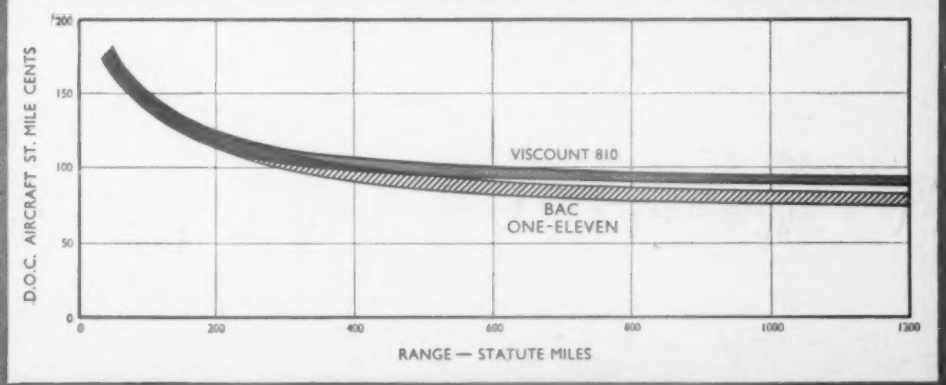
PAYLOAD v. RANGE

The BAC One-Eleven can carry its full complement of 57 mixed class passengers and baggage at 500 mph for stages of 1,070 statute miles with two hours reserves. It can carry 43 passengers for 1,500 miles



ECONOMICS

These bands cover seven separate methods of costing —ATA (1955), ATA (1960), SBAC and those of four airlines



BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1 ENGLAND

TOA BAC 8

civil or military

twin engine Mobility

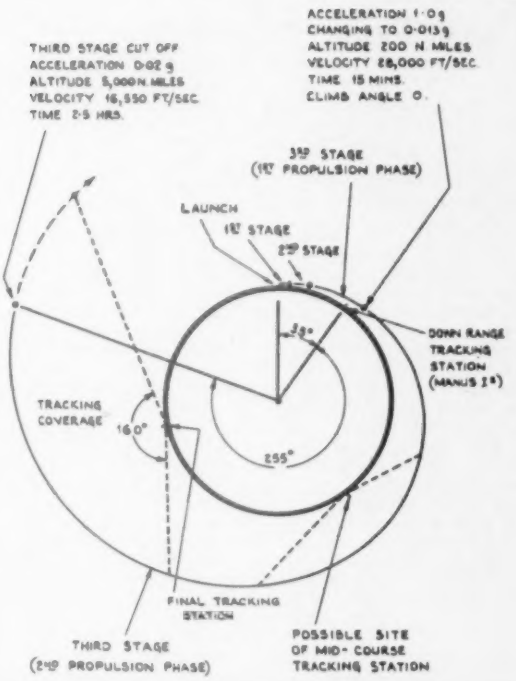
Designed primarily for military use, this twin engined twin rotor helicopter, the Belvedere, which has recently gone into service with the Royal Air Force can carry 19 fully equipped troops over a range of 400 nautical miles and can prove to be an extremely useful vehicle in the field of tactical mobility. As a civil passenger vehicle it can be developed as an airliner to carry up to 23 passengers in comfort from city centre to city centre or on feeder line work. A feature of the Belvedere is its ability to operate with full payload on only one engine. The design of the transmission system automatically permits both rotors to be driven by either engine should circumstances dictate. This capability is a special requirement for the commercial use of the modern helicopter and the civil version of the Belvedere is well suited in this respect.

WESTLAND *the great name in* **HELICOPTERS**

WESTLAND AIRCRAFT LIMITED YEOVIL ENGLAND

Incorporating Saunders-Roe Division, Bristol Helicopter Division and Fairey Aviation Division.

Launching trajectory from Woomera for placing a communications satellite in a polar orbit at 5,000 n. miles, assuming a LH_2/LO_2 third stage.



(*Continued from page 52*)

the most complex part of the systems could be fairly simple and light, beacons or transponders; the disadvantages were that complex and usually expensive ground equipments were needed, and that fairly strong limitations were placed on directions of launching, in order to avoid the installation of multiple guidance systems.

It was of interest to draw special attention to the guidance of high-circular or any high-perigee launchings. The high orbit was, of course, obtained most economically by an initial launch into a low orbit followed by transfer to the high orbit either by coasting or under continuous thrust. This orbit transfer, when done economically, would involve roughly a half revolution of the Earth for the coast system and rather more for a continuous thrust system.

A coasting trajectory using radar guidance would probably need a minimum of two guidance stations in the launch area (one in the immediate vicinity of the launch, one at transfer orbit injection) and one at final orbit injection. A continuous thrust system, Mr. Lyons said, may need an additional radar guidance station for mid-course guidance which, however, could be omitted if the thrust programme was of sufficient accuracy (i.e. within ±1% in the final stage).

Payload capabilities based on the Anglo-French rocket combination, with the illustrative H.T.P./kerosene third stage, were widely variable. By trading propellent against payload according to the desired mission, it would be possible to place one-ton of actual payload in orbit at 300 n. miles to 500 lb. in a 6,000-7,000 mile circle or in an elliptical orbit out to about 50,000 n. miles from a 300-mile perigee.

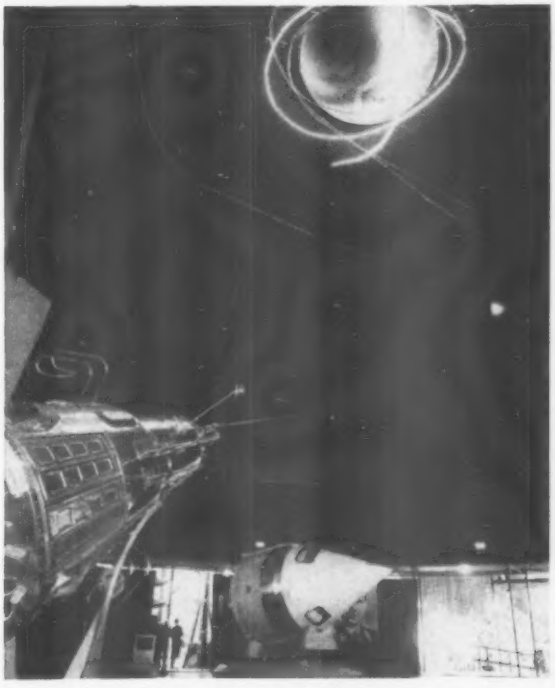
In obtaining these results, Mr. Lyons remarked, stage weights and flight programmes had been optimized as far as possible. In general, the stage-weight/payload curves were fairly flat around the optimum point, and it had been found advantageous to choose end weights slightly off optimum on the "light" side for a number of reasons, such as the location of the impact point of the discarded first stage in an acceptable area.

The "payload into orbit" figures were considerably improved, as would be expected, using a liquid-hydrogen/liquid-oxygen third stage. This was especially marked in distant orbits, where the third stage effective incremental velocity became a much larger proportion of the whole mission characteristic velocity.

A payload of about 1½ tons could be put into a near 300-n.-mile orbit or ½ ton could be placed in orbit at 7,000 n. miles.

In the Hall of the Cosmos

ONE of the premier attractions of the Soviet Trade and Industry Exhibition which opened at Earls Court last Friday is the Cosmos Hall, which contains full-size reproductions of some famous Soviet "space hardware." Included are Sputniks I, II and III, Lunik II, and the last stage of the carrier rocket which launched an early Lunik towards the Moon. Although all have variously been displayed before—in Moscow, New York and Brussels—London is seeing them for the first time.



Most impressive of the collection at Earls Court is the Lunik carrier rocket which is complete with a replica of the probe within its nose-cone; this can be observed through two cutaway panels just in front of the nose-cone attachment.

Of the rocket engine which powers this final stage of the launcher there is no clue, for the back end has been falsified by the addition of a domed plate and an end plug simulating the thrust chamber. The exhibit measures 15 ft. 6 in. from nose to back and has a diameter of nearly 8 ft. 6 in. The end plug measures about 38 in. across.

It is particularly unfortunate that the various space exhibits are not properly identified and more than one visitor must have gone away with the impression that the Lunik launcher was, in fact, a reproduction of the Vostok spacecraft which carried Major Gagarin around the Earth. The presence of a large photograph of Gagarin beside the exhibit does not help.

As we reported last week, the Vostok spacecraft is not on view, nor at the time of writing is there even a model.

Further confusion was added on Saturday when a film illustrating a short lecture by Dr. G. N. Zhdanov on "Man Into Space," was announced as showing the launching of the first Sputnik. This turned out to be an elementary account using models and animation, in which a shot of a German V-2 had been included to simulate the launching.

Showing simultaneously on a group of five screens in the Cosmos Hall is a short programme depicting early work by the Soviet rocket pioneer, Ziokovskii, the Sputniks and Luniks, and examples of aero-medical research including a man-carrying centrifuge and experiments with ejector seats. The Gagarin episode is illustrated by familiar photographs. This is followed by a speculative account, in colour, of the conquest of space with landings on the Moon, Mars and Venus, and lastly *interstellar* travel. The attraction of this film show is not so much technical as for the imaginative way in which it is presented, with various scenes and stellar backgrounds dissolving and appearing on different screens at the same time without the slightest distraction for the viewer.

The Exhibition remains open until July 29.—K.W.G.

Left to right, replicas of Sputnik III and final stage of the Lunik II carrier rocket; above, Earth-Moon trajectories.

Personal Flying

A meeting to discuss the formation of a British Chapter of the Experimental Aircraft Association is proposed by Arthur Ord-Hume at the Kronfeld Club, 74 Eccleston Sq., S.W.1, on Saturday, Jly. 15 at 19.15 hrs. Some recent films of American home-built aircraft will be screened, in addition to a general discussion on the advantages of joining this vigorous American organization.

• • •

Further details are now available of last week's delivery flight of a Mooney Mk. 21 from Boston to London. Except for the installation of special long-range radio and an extra 140 U.S. gal. fuselage fuel tank, the Mooney was a standard production model, and was about 150 lb. above its normal gross weight of 2,450 lb. for take-off.

With its extra fuel, and standard 48 U.S. gal. wing tankage, the Mooney had an endurance of about 29 hr., at economical cruise of 150 m.p.h., giving almost a 50% range margin. Ground speed was actually over 160 m.p.h., despite mixed weather, including snow, rain, ice and thunderstorms. Fuel consumption was only 6 Imp. gal./hr., and the Lycoming 0-360 used only four quarts of oil during the 20½ hr. flight.

Keith Johnstone, sales manager of R. K. Dundas, Ltd., the U.K. Mooney agents, tells us that the Ministry staff at London Heathrow were most co-operative and enthusiastic in assisting with the arrival of the Mooney, which was the first single-engined lightplane to land there under the new regulations.

• • •

● Winner of the navigation contest for the *Express and Star* trophy during the Wolverhampton Aero Club's competitions on Sunday, Jne. 25, was again Dr. Leslie Hamp. The doctor, who has won this contest several times in its post-War history, completed the 68-mile course with the least penalties. Second and third places were taken by Douglas Jemmett and K. Oakley.

METAL MOONEY.—Sole distinguishing feature of the new Mooney Mk. 21, apart from its metal wing, is its small dorsal fin. This first British-registered example was recently flown across the Atlantic.

● Three new instructors have joined the Oxford Aeroplane Club, which also has several new aircraft. These include Tri-Pacer G-ARGY, equipped with VOR, ADF and ILS for instrument training in conjunction with the Link trainer. Club member Michael Eustathiou has taken delivery of a new Piper Aztec, which was flown immediately on a trip to Athens by the owner and Bunny Austin.

● An "At Home" is being held by the Waveney Flying Group at Seething airfield, Norfolk, on Sunday, Jly. 23, from 10.00 hrs. onwards. A good turn-out is always a feature of these East Anglian meetings, and intending visitors are invited to advise club chairman James Hoseason, at 89 Bridge Rd., Oulton Broad, Lowestoft, of their arrival.

Gliding Notes

by Dr. A. E. Slater

FIRST to exceed 500 kilometres in India is Mr. Prem Singh of the Delhi Gliding Club. On Apr. 20 he had a launch at 10.56 hrs. in a German 16-metre Ka-7 two-seater, flying it solo, and set off in a south-easterly direction with the wind blowing from S. instead of N.W. as forecast. However, the forecast came true farther on.

It was necessary to keep a main road within gliding distance, and this meant following the roads closely at first, when his average height was only 3,000 ft.—evidently the morning thermals were of the English type. But in the afternoon, at about 14.00 hrs., cumulus clouds appeared; and, though dust devils gave better lift, the clouds did at least indicate that thermals were going higher. In fact, Mr. Singh got up to 8,500 ft. in a 20 ft./sec. thermal for a crossing of the Ganges a few miles before Kanpur.

The contrary wind at the beginning had put his 330-mile goal of Fyzabad out of reach, so he by-passed Lucknow, the finishing point of the previous Indian distance record, and followed the wind and the Sultanpur road farther south. From 7,000 ft. in the last thermal of the day at 17.30, Mr. Singh glided down to a landing by Aligang village at 18.15 hrs. The distance was 325 miles.

There are now 27 Silver "C" and eight Gold "C" pilots in India, and six Diamonds have been won.

* * *

India is now to have a gliding magazine, called *Silent Flight*. Mr. N. Walla, the editor, hopes to produce the first number this month. Since there are only five gliding clubs in the country, its function is not merely to keep existing club members in touch, but to circulate among large numbers of likely recruits.

Indian gliding has taken quite a time to progress this far from the training camp at Aundh held in December, 1931, with one primary glider of American make. Yet Indian soaring birds were being studied intensely many years before large-scale human soaring began.

Sir Gilbert Walker, the meteorologist, during his 21 years in India as Director-General of Observatories, studied the soaring of vultures and wrote a scientific thesis about it; and Dr. E. H. Hankin filled many note-books with thousands of observations and in 1911 published a book, "Animal Flight," in which he attributed their soaring to an ability to extract energy from the air by some unknown process on a molecular scale.

Hankin never offered any explanation of why the birds flew in circles, and flatly refused to believe that they used upcurrents. He lived just long enough to write to Eric Collins, who made the first British thermal flights in 1933—not to find out what Collins thought was keeping him up, but to ask the nature of any climbing instability he experienced.

The Sailplane and Glider for Aug. 26, 1932, reported that Sir Gilbert Walker had lectured on vultures to the German gliding people at Gersfeld, and that Robert Kronfeld intended going to India to investigate meteorological conditions for soaring flight in hot countries, and had submitted a scheme to the Director of Civil Aviation; but nothing came of it.

Now, at last, the Indians themselves are forging ahead. Up till a couple of years ago, I understand, their style was cramped by an official ban on human cross-country soaring. But they couldn't ban the vultures.

* * *

AT Terlet, near Arnhem, the Dutch had six contest days for their National Championships from May 20 to Jne. 3. The tasks were: 71 miles out-and-return; goal race to Hamburg, which only one pilot reached; 80-mile race to Beck; 300-km. triangle, which nobody completed; free distance in which two pilots exceeded 500 km. to Deauville; and 100-km. triangle race on a poor day, when luck of the launch mattered most.

Arie Breunissen won the contest in a Ka-6. Second, in another Ka-6, was Miss Hetty Amade, who broke the Dutch feminine records for out-and-return on the first day, goal flight on the third, and distance (289 miles) together with duration (7 hr. 7 min.) on the fifth; while on the 300-km. triangle day she beat all the men with 280 km.

A British Sky, flown by Eddy van Bree, finished third. The new Dutch Standard Class machine, the Sagitta, finished sixth. Out of 23 competing machines, 14 were British, 10 being Skylark 2s.

* * *

The German National Championships had poor weather and barely managed to fit in the minimum of four tasks. Rolf Spanig in a Zugvogel won with 2,673 points and E. G. Haase, former World Champion, was second in a Phoenix-T, with 2,389 points. Heinz Huth, the present Standard Class Champion of the World, appropriately won in the Standard Class with a Ka-6BR.

Correspondence

Vostok Speculations

I WOULD like to ask Mr. Lionel Butcher (THE AEROPLANE AND ASTRONAUTICS, Jne. 22) what grounds there are for his statement that ejectable cabins common to Spacecraft II and Vostok were mounted athwart-ship. Granted a photograph in the article under discussion (THE AEROPLANE AND ASTRONAUTICS, Apr. 20) of an earlier dog-carrying rocket demonstrates a lateral arrangement of a pair of containers but the trajectory in that case was non-orbital.

The lines of the only orbital cabin exterior yet published by the Russians, supposedly capable of carrying a man, assume classic nose-cone geometry namely a shuttle-cock configuration with the wide end trailing. If this is to be carried sideways on in the rocket as Mr. Butcher suggests, weight tends to be distributed unevenly, space is wasted, and the growth of the outer casing becomes vast (if I understand him correctly). Surely it is more likely that the cylindrical container, its wider auxiliary compartmentation, and the outer shielding are all mounted concentrically.

It would be interesting to hear if there is any fresh evidence in favour of another assumption of Mr. Butcher's that Vostok is a development of the winged T.4A or a DynaSoar type of vehicle. His suggestion of a pivoting seat is interesting but I believe that a hinged heel of the back-rest capable of somersaulting the pilot backwards would be a tidier answer than yawing him on a turn-table type of cushion.

A hammock-seat of the former type has actually been tried out by Boeing (see THE AEROPLANE AND ASTRONAUTICS, Oct., 30, 1959), and if the Russians are vertical-launching it explains how Major Gagarin's view could be returned after take-off from the nose port and controls to the rear windows.

Mr. Butcher's third assumption, that I query the size of the lift said to be on the point of raising Major Gagarin to the nose of the rocket, is incorrect. My objection was that there is no sign of functional lifting mechanism unless the send-off party is being held on the top floor previous to a descent.

Cirencester. G. B. BATHURST.

Freedom with Control

I HAVE read Mr. Peppitt's letter (THE AEROPLANE AND ASTRONAUTICS, Jne. 22) with interest and a good deal of sympathy, but his second solution that a Control Officer can be *Prosecutor* and *Judge* in his own cause is only possible in countries not governed by British Justice.

I suggest that Courts of Law are quite capable of both deterring potential evil-doers and punishing proved infringements of the law—aviation or otherwise.

Otherwise he has my enthusiastic support, I would even go further and make it compulsory for all aircraft to carry radio with frequencies of at least the airport where they intend to land.

A further point is that all instructors at flying schools, as part of the training for the Private Pilots Licence should be qualified and equipped to teach cloud flying to enable pupils to land safely if caught out in IFR conditions.

May I say, as a private pilot, once Jersey Control were satisfied I was not a "Kamikaze" their treatment of me was most considerate and similar to that offered to a charter pilot. Their equipment and talk-down procedure is unsurpassed.

Private pilots, usually, cannot afford the radio equipment of crack scheduled services but we can carry VHF, we can do what we are told in controlled air space; and believe it or not, nothing is sweeter to our ears than the voice of a control officer—preferably through the earphones!

London, W.1. L. H. RIDDELL (G-AHGD).

Ultra-light Helicopters

MAY I please have the use of your columns to correct what I consider to be a rather misleading remark in the "Personal Flying" column on p. 639 of your issue for Jne. 1.

At the end of the paragraph on the Skyskooter machine, you comment that experience has shown that "considerable care and skill are needed to build and operate such craft (i.e. Bensen and similar gyrocopters) with safety."

Whilst this statement is perfectly true, it appears to give the impression that this type of aircraft in fact requires *more* care and skill than other light aircraft. Having built two of this type of machine, and operated them for some little time now, I feel that this statement is quite misleading and requires some correction.

Obviously any flying machine must be constructed with "considerable care and skill" to maintain any safety whatever. However, the construction of the Bensen machines in particular is such that any averagely careful home builder, using normal common sense, could build a perfectly safe aircraft.

With regard to their operation, it is obviously not desirable for anyone to leap into the air in *any* type of aircraft, without some flying training and experience. This has in fact happened on many occasions in the United States, and is of course the main factor in the poor reputation which this type of machine appears to be (wrongly) acquiring. If the same procedure were applied to normal fixed-wing aircraft, one can well imagine that the number of "incidents" would be even greater.

Provided a machine of this type has been constructed and checked with normal care, and that its operation is learnt by easy stages, I would maintain that it is one of the safest types of vehicle available today. It can safely be flown with what is in fact very little pilot training as we know it for ordinary aircraft, and has remarkably few vices. It could certainly be safely flown by many people who would find a normal aircraft beyond their capabilities. Above all of course it cannot stall or spin, and in the worst extremity it is its own built-in parachute.

Luton, Beds. S. J. BARTLAM.

Groundabout

Black Mark. At the annual R.A.F. versus Industry golf match, the Service practically always wins—a state of affairs noted by Lord Portal, chairman of B.A.C., in his speech at the dinner after this year's match. And he recalled that the only time the Industry won, in 1956, it was followed in 1957 by the dreaded White Paper.

*

Vitally Statistic. If averages and statistics mean anything, the safest way to travel is by space-vehicle —two journeys, two successes, 100% safety record. Even the Australian airlines can't quite match this, although they probably take a poor view of the vehicles' utilization figures.

*

Non-Profit Delights. Speaking of wit, the Australians are still shuddering about the Russians' profligate use of one of their Tu-114s at the time of the British Trade Fair in Moscow. A lunch, presided over by Tupolev himself, was held in one of the mighty airliner's dining halls, and was still going strong at five o'clock. An Aussie airline friend started working out the revenue loss of one 200-seater standing on the tarmac for five-plus hours, but broke down. Couldn't read his slide-rule for tears.

*

Any Questions? "'Capacity measurement' means measurement in terms of capacity."—*Extract from the Weights and Measures Bill.*

*

How much is that doggie in the window? Now let's come up to date with the good news that Beagle are offering their Airedale for cash or on a long leash.

*

"Well no sir, I don't know aerodynamics but I do know of them . . . ."

by Gren

Industry Record

Radar and Electronics Plastics

The plastics department of English Electric Aviation's guided weapons division at Luton which for several years has been supplying components for the company's guided missiles, has recently been expanded to do work for the general radar and electronics industries. The complete design of radar transparencies, aerials and radar reflectors is now being undertaken and the company is fully equipped for microwave testing, stress analysis and computer programmes. Manager of the plastics department is Mr. P. R. Green. Mr. G. F. Meades is responsible for production and Mr. H. H. Starte is in charge of the plastics development laboratory.

Simulators For Sweden

We hear from the Solartron Electronic Group, Ltd., that its new six-target fully transistorized radar simulator (illustrated on this page in our Jne. 22 issue) has been ordered by Sweden. Ten units valued at £150,000 are to be supplied; deliveries will begin next January.

Approved

Full A.R.B. approval has been given to the range of self-contained 3½-in. artificial horizons which Ferranti, Ltd., produce for mounting on sloping instrument panels. The three instruments which comprise the range are compensated for installation at 10°, 15° and 25° from the vertical; type numbers are FH7L, FH7J and FH7K respectively. First application of these instruments has been in helicopters.

Airport Address Contract

A contract for the installation of the public address system in the new terminal building at Kai-Tak Airport, Hong Kong, has gone to Westrex Co., Ltd., of Cricklewood. Some 300 loudspeakers will be sited throughout the public areas controlled from two master announcing positions. The complete system will be similar in many respects to that installed by Westrex at Gatwick Airport.

Filter News

Fram Filters, Ltd., a new company which came into being on Jly. 1, has been formed to take over completely the manufacture and marketing in the U.K. of the range of filters and water separators produced by the Fram Corpn. of Providence, Rhode Island, U.S.A. Since 1938, the sole licensees for these products in this country has been Simmonds Aerocessories, Ltd. From them Fram Filters have acquired the complete engineering, research, manufacturing and sales facilities including a newly constructed factory of 90,000 sq. ft. at Treforest, Pontypridd, Glamorgan. In addition, sales and export offices will be maintained in London.

One of the main functions of the new British company will be to provide advanced product research in all types of air, fuel, oil and water filters and a close sales and engineering liaison with all licensees from the Fram Corpn. in other countries.

New From Hellermann

Hellermann, Ltd., has added to its range of wire strippers the H.35 series—the de luxe model of which has been designed for use on aircraft and guided weapon cables and similar work. This tool has been designed to strip without nicking or scraping wire and without marking insulation. The standard model is intended for normal commercial use being particularly suitable for production stripping of lighter gauge wires, automatic wiring, radio and instrument wires and cables and the like. Both tools weigh 14 oz.

Television Conference

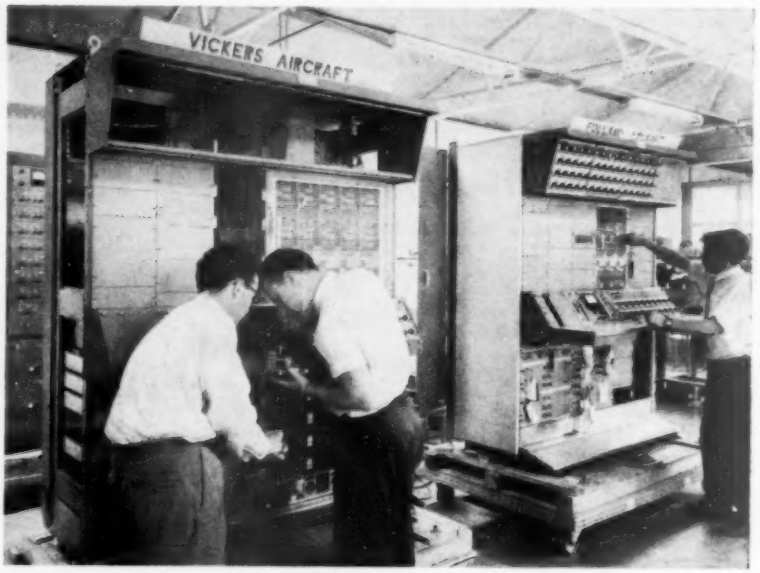
The Electronics and Communications Section of the Institution of Electrical Engineers is organizing an International Television Conference covering all scientific and engineering aspects. It will be held in London from May 31 to Jne. 7, 1962.

This period will overlap the last three days of the International Instruments, Electronics and Automation Exhibition being held at Olympia at that time, at which most British and many overseas manufacturers of television equipment and apparatus will be exhibiting. Arrangements are being made for linking with this exhibition, and it is expected that the coincidence of these two attractions will increase the number of electronics engineers and technologists from abroad, who will take the opportunity of attending both events.

The Conference will cover technological aspects of the whole television field, including programme engineering, transmission, reception, standards, colour, industrial and educational television, links and relay including the use of communication satellites. A comprehensive technical programme will include about 150 lectures and papers.

Middle East Haulers

For use on general duties at Khartoum, Jidda and Cairo airports, David Brown Tractors (Sales), Ltd., has recently delivered 14 Taskmaster aircraft-towing tractors to United Arab Airlines.



On show at the recent official opening of the Burgess Hill factory of Electronic Associates, Ltd., was the PACE 231R high-accuracy analogue computer for Vickers-Armstrongs (Aircraft), Ltd. (left) and the 221R for Folland Aircraft, Ltd. (right).

Aviation Calendar

Jly. 13

Baginton.—Coventry Air Pageant including Lockheed International Aerobatic Competition and King's Cup Air Race; until Jly. 15.

Jly. 14

Angers.—Angers Gliding Week; until Jly. 23.
Mejane.—Marseilles-Provence Aero Club Rally; until Jly. 15.

Jly. 15

Brawdy.—R.N. Air Station At Home.
Culdrose.—R.N. Air Station At Home.

Jly. 17

The Hague.—AGARD Fluid Dynamics Panel Meeting on "Use of Rocket-propelled Models in Flight Research"; until Jly. 21.

Jly. 19

London.—Kronfeld Club Film Show, "History of the U.S.A.F. 1942-43," at 74 Eccleston Square, S.W.1.

Jly. 22

Lossiemouth.—R.N. Air Station At Home.

Jly. 23

Seething.—Waveney Flying Group At Home, at 10.15 hrs.

Company Notices

NEW COMPANIES

Air Ferry, Ltd. (696,099).—Private co. Reg. Jne. 21. Cap. £100 in £1 shrs. To carry on the business of operators and owners of airlines. Sec.: C. L. Stammers. Sols.: Miller and Smiths, E.C.3. Reg. off.: 26 Lime Street, E.C.3.

Duke Aviation, Ltd. (695,840).—Private co. Reg. Jne. 16. Cap. £5,000 in £1 shrs. To establish and maintain air charter and air freight services. Dirs.: Neville F. Duke and Mrs. Gwendoline D. Duke, both of "Spinners," Green Lane, Alford, Surrey. Sec.: Mrs. G. D. Duke. Reg. off.: 2-4 Fitzroy Street, W.1.

Liverpool-West African Terminals, Ltd. (696,110).—Private co. Reg. Jne. 21. Cap. £10,000 in £1 shrs. To carry on the business of carriers of passengers and goods by land, water and air; forwarding agents. Dirs.: Malcolm B. Glasier, Broad Oak, Grange O'd Road, West Kirby; Thomas Kennan, 6 Dibbinsdale Road, Bromborough; Gerald E. Pearce, John Merriweather and Francis D. H. Mather. Reg. off.: South West Toxteth Dock, Liverpool, 3.

Overseas Flying Services, Ltd. (694,453).—Private co. Reg. Jne. 2. Cap. £1,000 in £1 shrs. To carry on the business of exhibition organizers and managers; air transport contractors. Dirs.: John Ferguson and Kenneth A. Hammond, both of 14 New Road, Brighton. Sec.: Margaret Melksham. Sols.: F. J. P. Veale and Co., Brighton. 1. Reg. off.: Delphin House, 14 New Road, Brighton.

New Companies

APPLICATIONS ACCEPTED

874,071.—**General Precision Systems, Ltd.**—"Ground-based aviation trainers." Sept. 12, 1957. (Jne. 12, 1956.)

874,196.—**Bendix Corporation.**—"Aircraft take-off monitoring." Aug. 11, 1959. (Sept. 4, 1958.)

Printed specifications of the above will be available on Aug. 2, 1961, and the opposition period will expire on Nov. 2, 1961.

875,032.—**Soc. Nationale d'Etude et de Construction de Moteurs d'Aviation.**—"Air-intake systems for engines of aircraft." Aug. 5, 1959. (Aug. 13, 1958.)

875,291.—**D. J. Evans.**—"Control of aircraft." Sept. 22, 1959. (Oct. 6, 1958.)

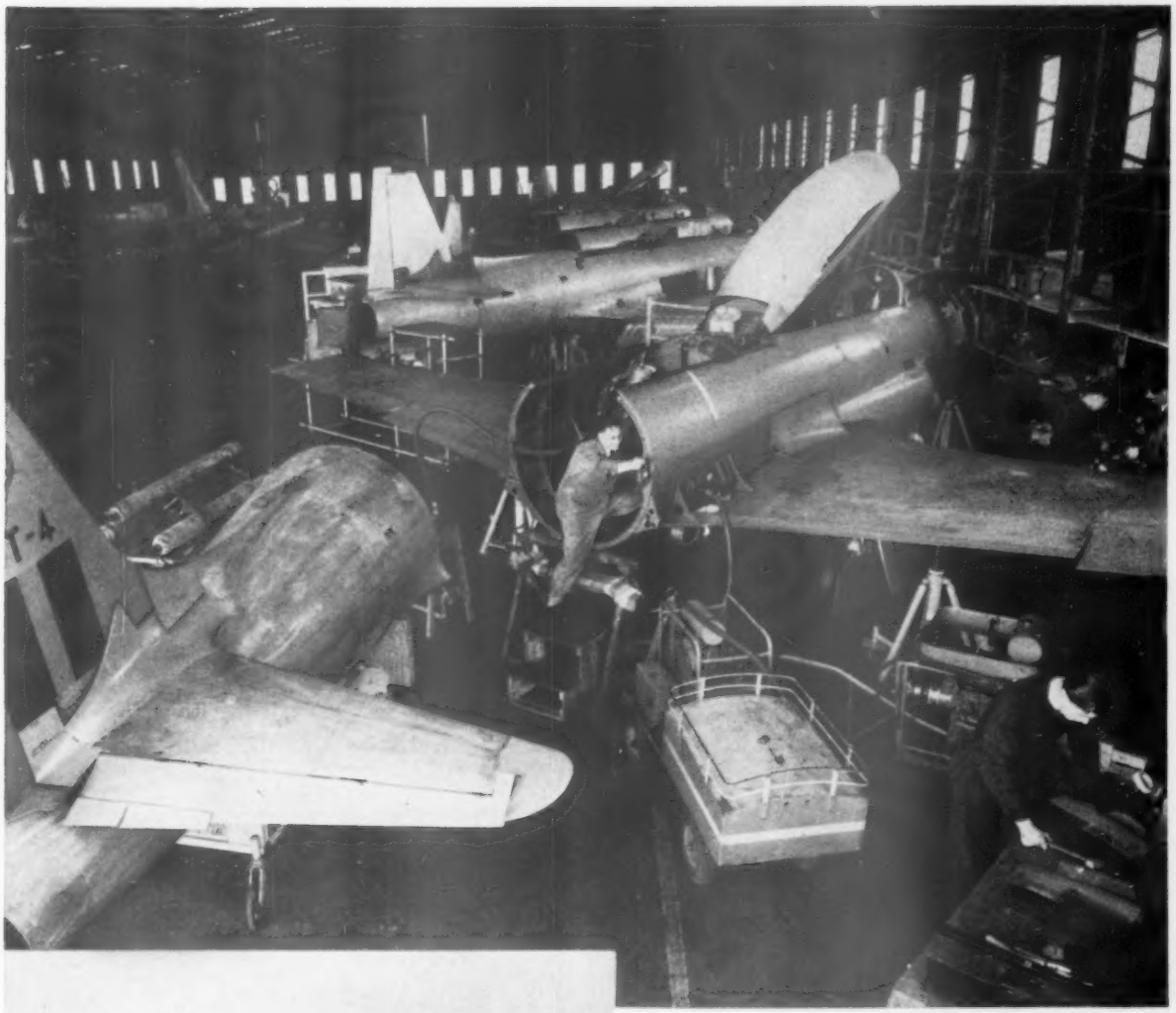
875,167.—**Soc. Nationale d'Etude et de Construction de Moteurs d'Aviation.**—"Rotary pulse jet engines." May 16, 1958. (May 18, 1957.)

875,205.—**Imperial Chemical Industries, Ltd.**—"Rocket propulsion." Dec. 9, 1959. (Dec. 31, 1958.)

875,295.—**Rolls-Royce, Ltd.**—"Engine mounting." Oct. 13, 1959. (Nov. 26, 1958.)

875,328.—**P. L. J. Chanut.**—"Guided missiles." Aug. 8, 1958. (Aug. 9, 1957.)

Printed specifications of the above will be available on Aug. 16, 1961, and the opposition period will expire on Nov. 16, 1961.



Photographs show stages in overhaul of T.33 jet aircraft at Tarrant Rushton.

FR services to the Aircraft Industry . . .

At Tarrant Rushton Airfield there is a special FR division which handles every aspect of aircraft maintenance . . . from minor modifications and repairs to complete overhauls. The Company has full approval for undertaking work up to A.R.B. and A.I.D. standards of inspection. Contracts for this highly skilled and specialised work have been carried out for eight different governments, and current commitments include the repair and overhaul of T.33 and F.84F jet aircraft for the Royal Belgian Air Force.

Flight Refuelling Ltd.

Tarrant Rushton Airfield,
near Blandford, Dorset
Telephone: Blandford 501
Telegrams: Refuelling Blandford

TA 1525

MALLITE

GALLEY EQUIPMENT

Meal Tray Boxes,
Bar Boxes
Equipment Boxes

Lighter, Cleaner, Stronger and more rigid

MEAL BOX, Type 1/108
(weight 10¼ lb.)

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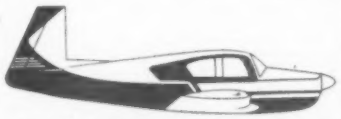

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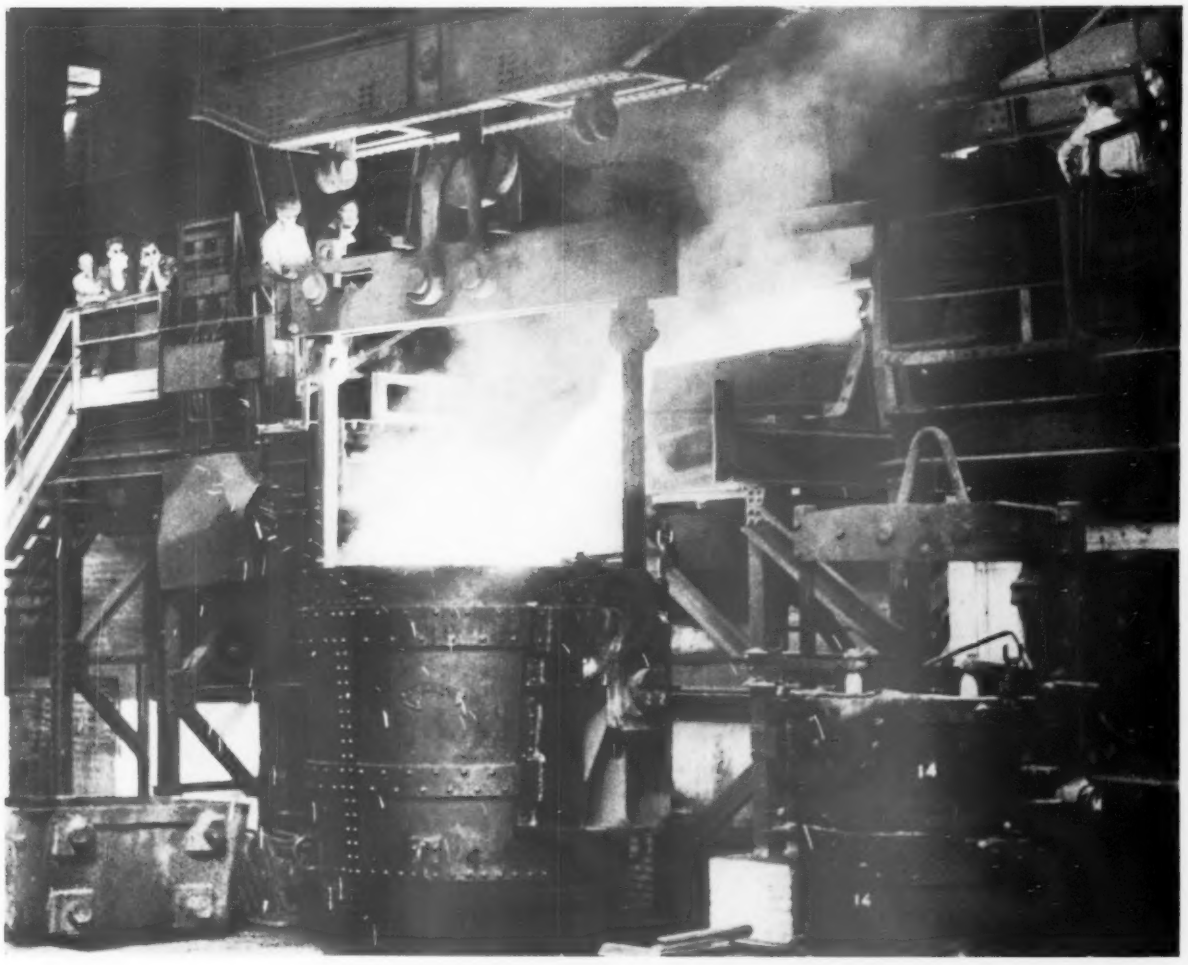

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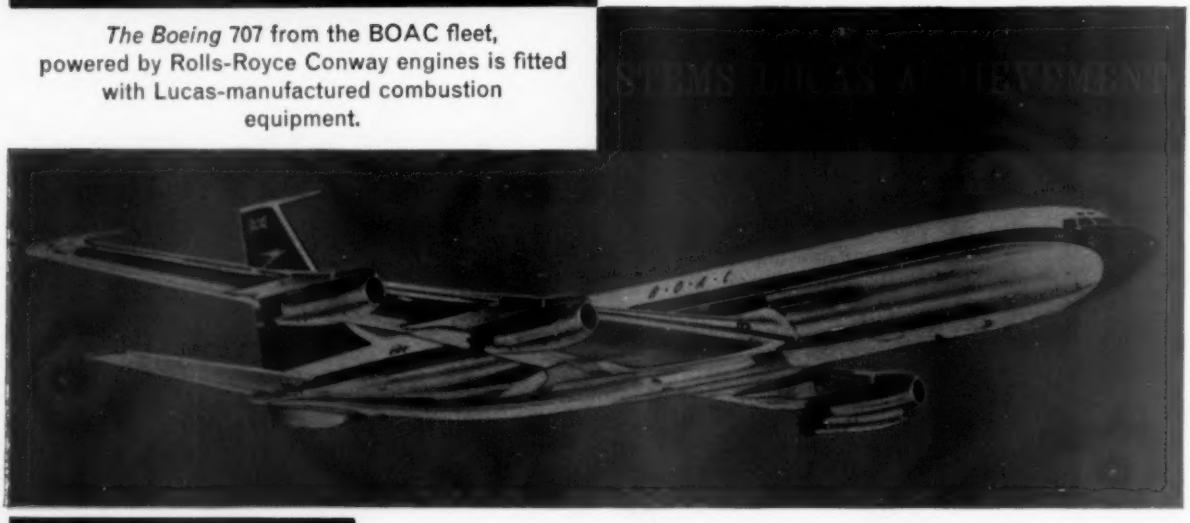

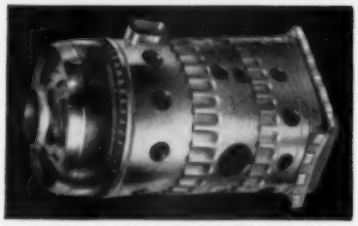

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